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THE JOURNAL OF

THE INSTITUTION OF PRODUCTION ENGINEERS

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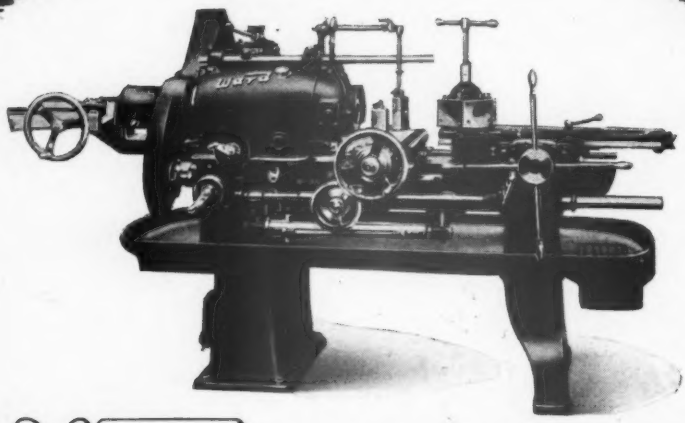

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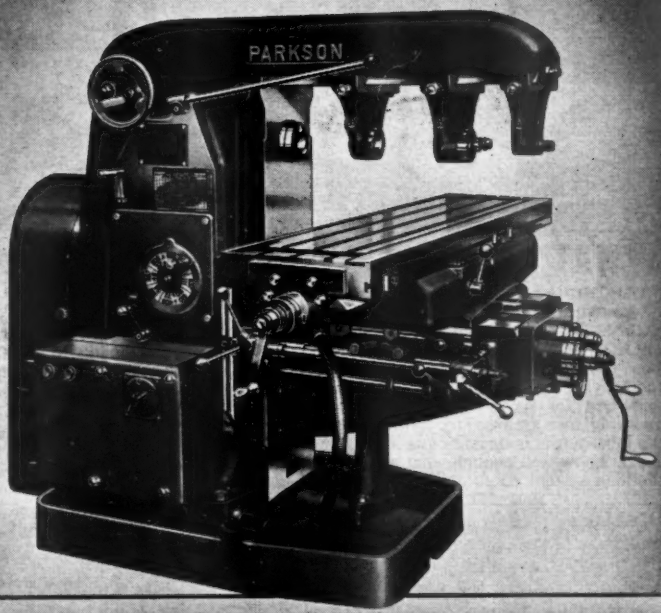

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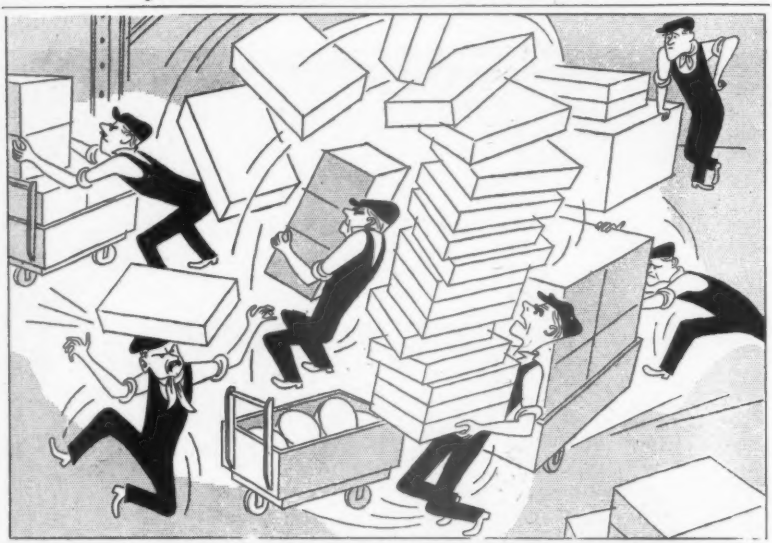

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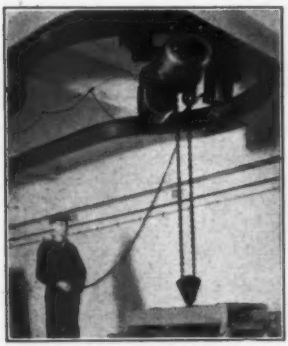

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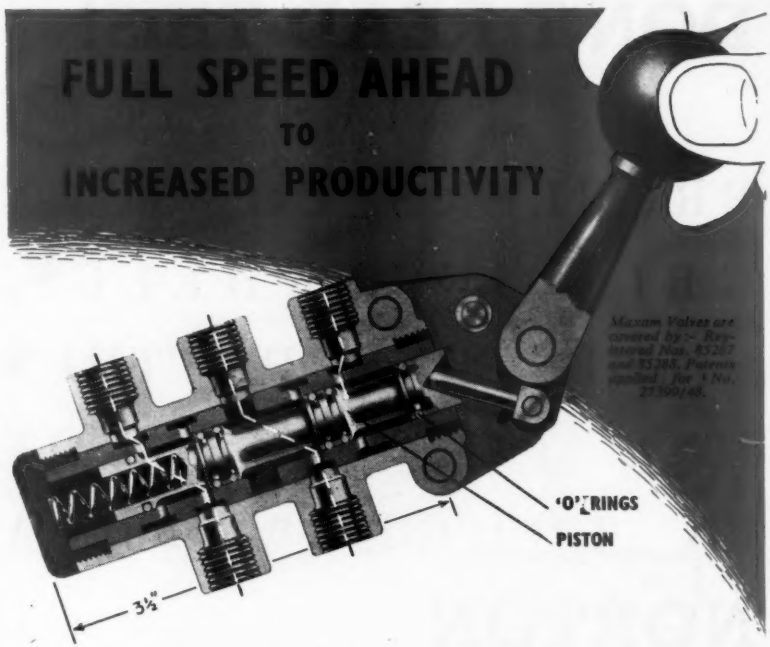

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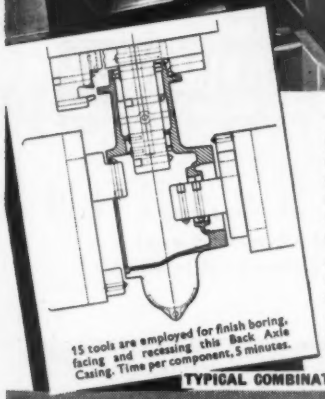

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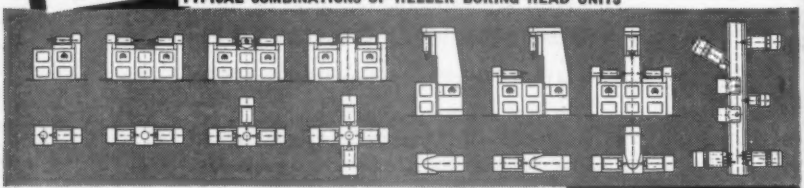

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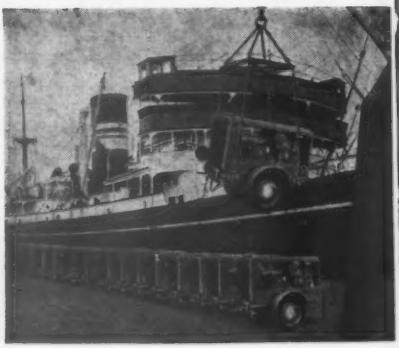

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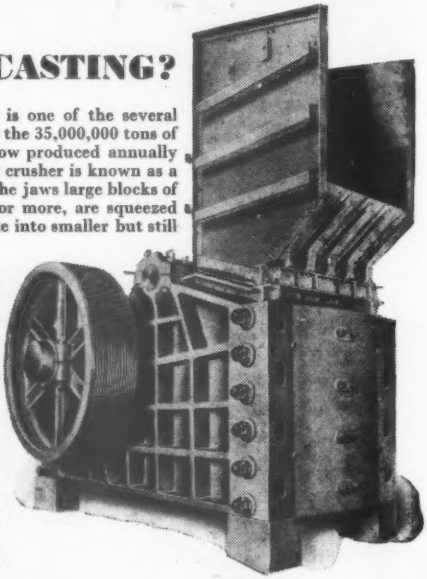

The crusher illustrated here is one of the several types which are used to process the 35,000,000 tons of quarried materials which are now produced annually in this country. This particular crusher is known as a primary crusher, and between the jaws large blocks of stone, some weighing one ton or more, are squeezed until they crack and disintegrate into smaller but still large fragments.

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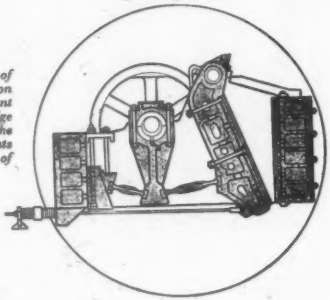

Waterloo Bridge is a typical example of the use of materials in the production of which crushing plant plays an important part. Both in the construction of the bridge itself and in the consolidation and the surfacing of the road and pavements crossing it, many hundreds of tons of quarried materials were used.

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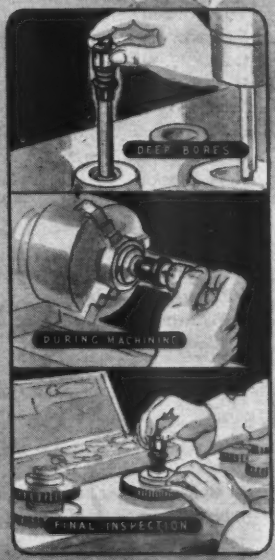

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Vol. 30, No. 3, March 1951

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MEMBERSHIP QUALIFICATIONS

THE standard of qualification for membership which is set by a professional Institution of any kind, will determine the status, the character and in time the policy of that Institution. The standard must therefore remain constantly under review by members who have an appreciation of the changing conditions of industry and of society, and their task is no easy one.

If the standard which they set is too rigid, the Institution will by its own action exclude many men capable of assisting it in its work and in advancing its aims. This will have a progressively ossifying effect on the life and work of the Institution, and will in its turn produce a most exclusive body which is so proud of its own status that it will have neither the spur nor the energy to perform the functions for which it was founded. If, on the other hand, the standards are too lax the Institution will rapidly acquire a large number of members of decreasing quality, with the result that in a very short space of time membership will be of no professional value. From this point onwards the discriminating among the professional class concerned will eschew it, and it will again cease to perform its proper function as a learned Society.

Thus it will be seen that standards of qualifications must remain the constant concern of this Institution, and it is interesting to follow the trends which are evident right from the first informal meetings which heralded its birth in 1921. It would have been so easy in those days for the founders to have opened the doors to all those who were interested, without necessarily being qualified in production matters. The Institution owes a debt of gratitude to its founders, for in their wisdom they avoided this easy path, and followed instead the slower but more certain one which lead to professional status and which, more important by far, has placed the Institution in a position to render really valuable service to industry and the teaching profession, and through them to the nation as a whole.

At the inaugural meeting which was held at the Cannon Street Hotel, London, on the 26th February, 1921, the first speaker emphasised the need for the production engineer to have a proper status and said that the Institution would " aid in developing a future generation of production engineers of a much better type than existed at the present time."

He was followed by another speaker who said that " the aim should be to get the best men they possibly could to join, and then the Institution would exert a very strong influence upon industry

. . . there would have to be a wise discrimination in fixing the classification of membership, because it was necessary to see that only real production engineers were admitted."

GROWTH OF ACADEMIC STANDARDS The Institution's early growth was slow but steady, and in the late 1920's, when membership was still well short of five hundred, consideration was given to academic standards. Until that time elections had in the main been confined to senior men, but it was apparent that young engineers were becoming interested. Quite apart from this, however, members were concerned at the lack of provision of courses specifically designed for engineers interested in the production function and they realised their duty to give a lead in this field.

Syllabi were prepared by a special Examination Committee, and in 1931 the first of the Graduateship Examinations was held. There were 27 candidates, of whom 19 were successful.

In 1950 the last of the Graduateship Examinations was held and of 177 candidates, 135 were successful.

As a result of persistent representations on the part of the Institution approval was given in 1942 for the introduction of a Higher National Certificate scheme in Production Engineering. It was very soon apparent that active consideration would have to be given to the revision of the Institution's examination requirements which became, as a result of the introduction of the new scheme, increasingly obsolescent.

New syllabi and examination regulations were prepared jointly by the Education and Membership Committees, and details of the Associate Membership Examination Regulations were announced late in 1948. Two years were given to colleges and other educational establishments to prepare their students for the examination under the new regulations, which finally came into force on 1st September, 1950.

The first of these new examinations will take place during the week commencing 21st May, 1951.

THE ASSESSMENT OF APPLICATIONS A procedure for assessing applications for membership has been developed over the years which, whilst ensuring that applications are considered in strict confidence, provides local knowledge of the applicant and his firm, and at the same time a common " yardstick " for all cases.

When an application is received at the Head Office it is checked to ensure that it is correctly proposed and seconded, and all the necessary relevant information has been given ; certificates confirming academic qualifications are then verified. Next, the information given on the form is extracted and copies are made for

the members of the Section Committee concerned and the central Membership Committee or, in the case of junior applications, the Education Committee, whose members are well qualified to examine and advise on academic and practical training problems.

The application is first considered by the Section Committee, whose Chairman enters a recommendation on a record form attached to the applicant's papers. It is next assessed by the Membership or Education Committee who make their recommendation before considering the views of the Section. If the two agree the case is placed before the next quarterly meeting of the Council for the decision to be ratified. If, on the other hand, there is disagreement, the papers are referred back to the Section and, if they stand by their original recommendation, back again to the Membership or Education Committee. In all cases where the Committees are unable to reconcile their differences of opinion the details of the application are printed in full in the Council papers, and the final decision rests with the Council, on which all Sections are represented.

PRINCIPLES INVOLVED IN ASSESSING APPLICATIONS

So far as applicants under the age of 35 are concerned certain definite academic and practical requirements must be met. Firstly the applicant must, if under the age of 30, have passed or gained exemption from Parts I and II of the Associate Membership Examination and have carried out a reasonable period of practical workshop training of a character approved by the Institution. Applicants between 30-35 must, in addition, have passed or gained exemption from Part III of the Associate Membership examination and satisfy rather more severe practical requirements, including the possession of an appointment involving responsibility for production.

When dealing with applicants over the age of 35 a rigid approach is not possible, especially when it is remembered that such applicants may cover a very wide age range. There are certain guiding principles, of course, but a great deal depends upon their interpretation by Committee members, who must be men of considerable experience and wisdom.

For instance, a man aged 36 will be expected to possess a fair amount of practical experience, but he will also be asked to produce evidence of academic qualifications of a standard comparable with the Institution's examination. On the other hand, favourable consideration may be given to a man aged 56 who, whilst possessing a vast amount of practical knowledge and experience, is weak on the academic side and comes from an area in which education facilities were poor when he was a youth.

Each individual case must therefore be weighed carefully in the

balance, for human beings, unlike machines, do not conform to a pattern and each one poses his own problems. The remark is sometimes made that " Smith, who is in my works, is an Associate Member, but I hold a senior position and yet you say I am not equally qualified." It should be remembered, however, that the Institution is usually looking for rather different qualifications than the employer, and as a result uses a different " yardstick." The fact that a man is not considered qualified for membership of the Institution is no slur upon his ability, for very often his particular qualifications, academic or practical, are of a type more suited to some other professional body.

TEACHERS The principles of assessment cannot be applied in exactly the same way for individuals engaged in teaching. Whereas the application may vary, however, the principles do not. While similar academic and practical training requirements are called for, it is obvious that teachers carry responsibilities of a type rather different from those of the production engineer in industry. Consideration is therefore given to his standing as a teacher, his responsibility for specifically production subjects, and the status and level of the college in which he serves and of the courses for which he is responsible. Thus a lecturer responsible for students in a course for the Higher National Certificate in Production Engineering might be considered eligible for Associate Membership, whereas another lecturer with a similar background but responsible for certain other courses in a college not recognised for Higher National Certificate work, might not qualify.

ASSOCIATES It has been found in the past that considerable misunderstanding exists regarding the status of Associates. Often it has been said that it is a grade to which those who do not quite qualify as Associate Members are elected. Nothing could be further from the truth. In fact it is a grade designed for individuals who possess qualifications equal to those required for full or Associate Membership. Such individuals fall in the main into two distinct categories. Some hold positions of responsibility, either executive or functional, in spheres related to, but not *directly* concerned with production. Others hold positions which involve considerable responsibility for the co-ordination or planning of production processes, yet possess practical and academic backgrounds in such spheres as accountancy, law or chemistry.

The evaluation of such cases is never an easy matter, because again no two cases are exactly parallel. The grade does nevertheless give an opportunity to men whose work is associated with production to join with those whose duties are solely concerned with it, and such a relationship must be of benefit to both sides.

This aspect is of particular importance when one considers the very wide range of activities which the production engineer is engaged upon. Equipped as he is with the education and training of an engineer, he is not necessarily only to be found in those industries which are concerned with metal working. Corporate Members of the Institution are to be found in the textile, rubber, paint, chemical, furniture, cutlery, glass, pottery and many other industries, and qualified production engineers from these varied industries are always eligible for corporate membership.

THE RESPONSIBILITIES OF MEMBERSHIP To end this article with no mention of the processes which take place after the applicant has been recommended for membership would be to give the impression that election involves the payment of an annual subscription and no further activity on the part of the new member. This is not so, and it cannot be too strongly emphasised that membership involves firstly a responsibility to add to the knowledge which the Institution can make available to industry and the nation. The Institution provides a platform from which this knowledge can be given, the circumstances and results discussed and studied, and the findings published and distributed for the benefit of others ; in particular of the students to come.

Secondly, it is the duty of qualified corporate members to guide and advise the students and graduates who will one day assume positions of responsibility in the Institution, industry and society. Work on committees, the reading of papers, participation in discussions and study groups are all invaluable in the development of a young engineer. He requires guidance and encouragement, however, if he is to benefit fully from these activities, and this can only come from those who have acquired wisdom, knowledge and maturity as a result of age and experience.

Too few members are fully aware of their responsibilities towards these activities, and as a result it is very often left to a relatively small number of individuals to undertake a very heavy burden of voluntary work. The Institution can make an immeasurably greater contribution to the problems which exist to-day if all its members would truly complete their membership by assisting it to undertake its duties and fulfil its aims.

They would do well to reflect on the following passage, which is contained in the declaration which they signed when applying for membership :

" . . . I will advance the objects of the Institution as far as lies in my power and will attend the meetings thereof as often as possible."

E. P. EDWARDS

THE MEMBERSHIP COMMITTEE

The Committee meets once a month in Birmingham to consider applications and other matters concerning the membership policy of the Institution. Mr. G. E. Knight is secretary of the Committee and the Education Officer, Mr. T. B. Worth, attends in an advisory capacity.

Mr. E. P. Edwards is the Chairman and has been a member of the Institution since 1928. He is Sales Manager of the Lapointe Machine Tool Co. Ltd. Member of Council, of the Finance and General Purposes Committee, the Education Committee and Joint Examination Board, and is a past President of the Birmingham Section.

Other members of the Membership Committee are :—

Mr. R. F. Beaton. Principal, Mansfield Technical College, Notts. Member of the Education Committee.

Mr. F. W. Cranmer. District Manager of Associated British Machine Tool Makers, Manchester. Elected member of Council October, 1943. Elected member of Education Committee December, 1943. Past Section Honorary Secretary of Manchester Section.

Mr. J. S. Daniels, M.I.Mech.E. Chairman of Messrs. T. H. & J. Daniels, Ltd., Stroud, Glos. Past President of the Western Section.

Mr. B. H. Dyson, F.I.I.A. Works Manager of Hoover Limited, Perivale, and Director of Hoover (Washing Machines) Ltd., and Merthyr Motors Ltd. Member of Council and of the Education and Research Committees. Past Section Honorary Secretary of the London Section.

Mr. R. P. Eccles. Managing Director of Diamond Tools Limited, Birmingham.

Mr. W. N. Ellerby. Efficiency Engineer at Humber Ltd., Coventry. Past President of the Coventry Section.

Mr. L R. Evans, M.I.Mech.E., Chief Maintenance Engineer, English Steel Corp. Ltd., Sheffield. President of the Sheffield Sec- Member of Council.

Mr. F. Osborne. Director and General Manager of William Ayrton & Co. Ltd., Gorebrook Ironworks, Manchester.

Mr. R. L. Paice. Sales Director, Igranic Electric Co. Ltd., Bedford. President of the Luton Section. Member of Council.

Dr. H. Schofield, C.B.E., B.Sc., A.R.C.S., M.I.Mech.E. Past President of the Institution. Member of Council, the Finance and General Purposes Committee, Education Committee and Joint Examination Board.

Mr. J. Silver. Production Manager, Jaguar Cars Ltd., Coventry.

Mr. H. Teasdale, M.Ed., B.Sc., A.Inst.P. Principal of the Apprentices' Technical School and Apprentice Manager of the Engine Division of the Bristol Aeroplane Company. Past Section Honorary Secretary of the Yorkshire Section.

Mr. F. V. Waller. Director and General Manager of Western Manufacturing Estate Limited, Director of Pest Control Limited, Chairman of the Reading Sub-Section.

INSTITUTION NOTES

March, 1951

MEETING OF COUNCIL The next Council Meeting will be held on Thursday, 26th April, 1951, at 11 a.m. at 36, Portman Square, London, W.1.

NEWS OF MEMBERS

Mr. R. F. H. Banister, Associate Member, is now Principal Assistant to the Regional Controller, British Electricity Authority, Southern Region.

Mr. F. H. Bates, Associate Member, and Mr. G. V. B. Bevan, Associate Member, will each be giving a series of six lectures at Croydon Polytechnic, commencing in April. Their respective subjects will be " The Manufacture, Design, and Application of Tungsten Carbide Cutting Tools " and " The Design of Compound and Multi-Stage Press Tools."

Mr. L. E. Broome, Associate Member, has been elected an Associate of the Royal Photographic Society.

Mr. L. G. Carver, Associate Member, is now Works Manager of Avimo, Ltd., of Taunton, Somerset.

Mr. B. H. Dyson, Member, has been appointed a Director of Merthyr Motors Limited.

Mr. J. Gilson, Associate Member, is now Chief Production Research Engineer, Hoover, Ltd., Perivale.

Mr. J. S. Hemingway, Associate Member, is now Production Control Manager, Hoover (Washing Machines) Ltd., Merthyr Tydfil.

Mr. C. R. Johnson, Associate Member, is now Production Manager at Rycroft Electric Co. Ltd. (a subsidiary of Aerialite Ltd.), Stalybridge, Cheshire.

Mr. A. McL. Knox, Associate Member, has been posted to the Lebanon as Area Engineer for his company, Shell Petroleum Co.

Mr. G. W. Lane, Associate Member, has been appointed Development Engineer at B. O. Morris Ltd., Coventry.

Mr. J. Loudon, Associate Member, is now Chief Inspector, Hoover Electric Motors, Cambuslang.

Mr. H. Parcell, Associate Member, is now Works Manager of the Small Arms Factory, Kalpi Road, Kanpur, India.

Mr. F. Scammell, Associate Member, has been appointed Material Control Manager, Hoover (Washing Machines), Ltd., Merthyr Tydfil.

Mr. J. C. Shapley, Associate Member, is now Chief Production Engineer, Hoover, Ltd., Perivale.

Mr. G. Smithies, Member, is now Works Engineer at the Hindley Green Factory of Turner Brothers Asbestos Co. Ltd.

Mr. A. W. Southall, Associate Member, is now a partner in the Northfield Engineering Co., Birmingham.

Mr. C. Toeman, Associate Member, has been appointed Works Manager of C. F. Caselton & Co. Ltd., London.

Mr. J. H. Turner, Associate Member, is now Material Control Manager, Hoover Electric Motors, Cambuslang.

Mr. H. V. Whittaker, Member, has been appointed Sales Manager, Machine Tool Division, of John Kimbell & Co. Ltd., London.

Mr. K. L. Brookfield, Graduate, has been appointed Senior Assistant for Industrial Administration at the Schools of Technology Art and Commerce, Oxford.

Mr. A. P. Oppenheimer, Graduate, is now Chief Time Study Engineer, Hoover Electric Motors, Cambuslang.

OBITUARY The Institution records with very deep regret the sudden death of Sir Harry Harley, C.B.E., Member, which occurred during a voyage to Australia in January last.

Sir Harry, who was widely known throughout the machine tool industry, founded The Coventry Gauge and Tool Co. Ltd. in 1913. Later he assumed full control and remained Chairman of the company until his death.

In 1942 he received the C.B.E. in recognition of special services to the Admiralty, and was created Knight Bachelor in 1950. He devoted much time to public service in Coventry, and had been a Freeman of the City since 1899. He was also a Burgess and Freeman of the City and Royal Burgh of Brechin, Scotland.

Sir Harry had been a member of the Institution of Production Engineers since 1926, and was a founder member and first President of the Gauge and Tool Makers' Association. He was also Vice-Chairman of the Production Engineering Research Association.

BOOKS RECEIVED "*Engineering Metrology*," *by K. J. Hume, B.Sc., A.M.I.Mech.E., M.I.Prod.E., Macdonald and Co. (Publishers) Ltd., London, price 18s. net.*

This book deals with engineering precision measurement in such a way as to make it a valuable addition to the literature on the subject. The approach may be considered as basic, since wherever possible the subject is related to the elements of Mathematics, Mechanics, Optics and Heat and Temperature.

A knowledge of the construction and use of the commoner measuring instruments such as micrometers and verniers is assumed,

and although the book is primarily concerned with application, a considerable amount of information on instrument design is included, particularly for instruments embodying optical systems.

An attractive feature of the book is the way in which geometric principles and comparative errors are used to indicate the choice of a particular method.

An excellent bibliography with chapter references is given, and this serves to illustrate the difficult choice which the author has had to make as to what should be included in the text.

" Engineering Metrology " should prove most useful to students of Production Engineering, and equally valuable in the practice of metrology.

T. B. W.

THE LIBRARY The Library will be open between 10 a.m. and 5.30 p.m. on Mondays, Tuesdays, Thursdays and Fridays; between 10 a.m. and 8 p.m. on Wednesdays; and between 10 a.m. and 1 p.m. on the first Saturday of every month.

Members are asked to note that the charge of one shilling to cover part cost of packing and postage on books borrowed by post has now been discontinued.

JOURNAL BINDERS Members are reminded that binding cases for the Journal are obtainable from Head Office, price 7/6 each post free. The cases, each of which will hold 12 issues of the Journal, are made of stiff board covered with imitation leather cloth, with gilt lettering on the spine.

CHANGE OF ADDRESS It would be of great assistance to Head Office if members would ensure that the business addresses contained in their records were up-to-date, and would notify Head Office as soon as possible of any change of appointment.

ISSUE OF JOURNAL Owing to the fact that output has to be adjusted to meet requirements, and in order to avoid carrying heavy stocks, it has been decided that the Journal will only be issued to new Members from the date they join the Institution.

IMPORTANT In order that the Journal may be despatched on time, it is essential that copy should reach the Head Office of the Institution not later than 40 days prior to the date of issue, which is the first of each month.

SECTION MEETINGS

The following meetings have been arranged to take place in April, 1951. Where full details are not given, these have not been received at the time of going to press.

APRIL

3rd **Reading Sub-Section.** A lecture on "The Refining of Oil" will be given by I. A. B. Pender, Esq., A.R.I.C., at the Great Western Hotel, Reading, at 7-15 p.m.

3rd **Lincoln Section.** The Annual General Meeting will be held in the Canteen, Ruston & Hornsby Ltd., Boultham Works, Lincoln, at 7-00 p.m.

4th **London Graduate Section.** A lecture on "Developments in Machine Tool Controls" will be given by F. H. R. Koeller, Esq., A.M.I.Prod.E., at the Institution of Production Engineers, 36 Portman Square, London, W.1., at 7-15 p.m.

4th **Nottingham Section.** A lecture on "Vehicle Maintenance" will be given by a member of the London Passenger Transport Executive in the Victoria Station Hotel, Milton Street, Nottingham, at 7-00 p.m.

4th **South Essex Sub-Section.** A lecture on "The Control of Quality in Medium and Large Quantity Engineering Production" will be given by J. Loxham, Esq., M.I.Prod.E., in the Reading Room, Conservative Club, Ilford, at 7-30 p.m.

4th **Wolverhampton Section.** A lecture on "Modern Adhesives" will be given by Mr. Johnson, at the Dudley & Staffordshire Technical College, Castle View, Dudley, at 7-00 p.m.

5th **London Section.** A lecture on "The Financial Aspect of Machine Tool Replacement" will be given by R. McNeil, Esq., F.C.A., A.S.A.A., at Gresham Room, Old Ship Assembly (entrance Ship Street), Brighton at 7 p.m.

6th **Luton Graduate Section.** A lecture on "Spinning a Yarn"—Cotton Manufacture, will be given by J. Horridge, Esq., M.I.Prod.E., at Luton Library Lecture Hall, Williamson Street, Luton, Beds, at 7-30 p.m.

6th **Coventry Graduate Section.** A lecture on "Plastic Materials in Production" will be given by A. Beecham, Esq., in the Greyfriars Rooms, Geisha Cafe, Hertford Street, Coventry, at 7-15 p.m.

9th **Sheffield Section.** A lecture on "Modern Marking Methods" will be given by A. Throp, Esq., M.I.Mech.E., at the Royal Victoria Station Hotel, Sheffield, at 6-30 p.m.

9th **Derby Sub-Section.** A lecture on "Rubber and Allied Materials" will be given by Mr. Reynolds, A.R.I.C., A.I.R.I., at the School of Art, Green Lane, Derby, at 7-00 p.m.

10th **Birmingham Graduate Section.** A lecture on "Defects and Developments in Deep Drawing and Pressing" will be given by Dr. J. D. Jevons, B.Sc., F.R.I.C., F.I.M., at the James Watt Memorial Institute, Great Charles Street, Birmingham 3., at 7-00 p.m.

10th **Dundee Section.** A lecture on "Starting a New Factory" will be given by A. R. Northover, Esq., M.I.Prod.E., at Mathers Hotel, Whitehall Crescent, Dundee, at 7-30 p.m.

11th **Liverpool Section.** The Annual General Meeting will be held at the Exchange Hotel, Tithebarn Street, Liverpool, at 7-15 p.m.

12th **Rochester & District Sub-Section.** A lecture on " Production of Automobile Gears " will be given by T. Vickerman, Esq., in the Rotary Room, The Sun Hotel, High Street, Chatham, at 7-30 p.m.

12th **Southern Section.** A lecture on " The Use of Rubber as an Engineering Material " will be given by G. W. Trobridge, Esq., B.Sc., at the Polygon Hotel, Southampton, at 7-00 p.m.

12th **Wolverhampton Graduate Section.** A lecture on " Press Tools " will be given by J. A. Grainger, Esq., A.M.I.Mech.E., A.M.I.Prod.E., at the Star and Garter Hotel, Wolverhampton, at 7-30 p.m.

14th **Reading Sub-Section.** There will be a works visit to " Shell " Refining & Marketing Co., Ltd., Shell Haven, Nr. Stanford-le-Hope, Essex.

15th **Liverpool Graduate Section.** The Annual General Meeting will be held at the Exchange Hotel, Tithebarn Street, Liverpool, at 7-45 p.m.

18th **Birmingham Section.** There will be a joint meeting with the Institute of Cost and Works Accountants and the Institution of Works Managers, when a lecture on " Measurement of Productivity " will be given by Walter C. Puckey, Esq., M.I.Prod.E., F.I.I.A., at the James Watt Memorial Institute, Great Charles Street, Birmingham 3., at 7-00 p.m.

18th **Manchester Graduate Section.** A lecture on " Production of Electric Motors " (illustrated by films) will be given by F. E. Beake, Esq., A.M.I.E.E., in the Reynolds Hall, (Room C.3.) College of Technology, Sackville Street, Manchester, at 7-15 p.m.

18th **Western Section.** A lecture on " Modern Adhesives for Industry " will be given by T. C. Ford, Esq., at the Grand Hotel, Broad Street, Bristol 1., at 7-15 p.m.

19th **Leicester Section.** Film Show, " The Hone Abrading Process " and " The Generation of Metallic Bearing Surfaces," in Room 104, Leicester College of Art and Technology, The Newarke, Leicester, at 7-00 p.m.

21st **London Graduate Section.** There will be a works visit to the National Physical Laboratory, Teddington, at 2-30 p.m.

23rd **Manchester Section.** A lecture on " Steam Turbine Manufacture " will be given by A. C. Annis, Esq., at the College of Technology, Sackville Street, Manchester, at 7-15 p.m.

24th **Birmingham Graduate Section.** There will be a works visit in the evening to Stewarts & Lloyds, Bilston Iron & Steel Works, Bilston, Staffs.

24th **Luton Section.** A lecture on " Special Electric Control Gear Applications " will be given by R. K. Fleming, Esq., M.I.Prod.E., at Canteen, Igranic Electric Co., Bedford, at 7-15 p.m.

24th **South Wales & Monmouthshire Section.** A lecture on " Measurement of Productive Efficiency " will be given by Walter C. Puckey, Esq., M.I.Prod.E., F.I.I.A., at the South Wales Institute of Engineers, Park Place, Cardiff, at 6-45 p.m. This will be a joint meeting with the local branch of the Institute of Cost & Works Accountants.

25th **Shrewsbury Sub-Section.** A lecture on "Induction Heating" will be given by W. J. G. Cosgrave, Esq., B.Sc., A.I.M., at the Walker Technical College, Oakengates, Salop, at 7-30 p.m.

THE COLLEGE OF AERONAUTICS

A Course of Lectures on

"MEASUREMENTS FOR MANAGEMENT"

will be given at the College from

MONDAY, 9th April to FRIDAY, 20th April, 1951.

This course is intended to familiarise executives in any industry with the modern practices and new developments in measurement of management factors in the following fields: work measurement, financial and cost measurements, dimensional measurements, machine tool and process plant measurements. The course will discuss special aspects such as quality control, job evaluation and modern methods of cost accountancy. Laboratory demonstrations will be available in each of the subjects covered by the Syllabus.

Fees for the course are:

Tuition Fee	15 guineas
Residence charge	16/- per day (including full board)

Copies of the Syllabus and Forms of Registration can be obtained from the Registrar, The College of Aeronautics, Cranfield, Bletchley, Bucks.

THE MASS PRODUCTION OF COINS

by MAJOR J. H. PARTRIDGE, R.E. (Retd.), A.I.Mech.E., M.I.Prod.E.

Presented to the Calcutta Section of the Institution, 12th December, 1950

THE origin of coins of regular shape is believed to have been as long ago as 700 B.C. in Greece and Asia Minor. The methods used in their manufacture have, of course, improved through the ages, but it is interesting to note that the present-day methods of producing struck coins has remained basically the same since an 18th century Birmingham manufacturer, named Boulton, in collaboration with James Watt, the famous inventor, first applied steam to the working of coinage machinery.

In this paper I will describe briefly some of the processes involved in the manufacture of coins in the Calcutta Mint, which was first opened for coinage in August, 1829. Brief references will also be made to the improvements in manufacturing technique which will be used in the new Mint which is nearing completion at Alipore.

BASE METALS AND ALLOYS USED FOR COINAGE PURPOSES

The base metals and alloys used for coinage purposes have varied considerably throughout the ages, and even to-day, a wide range of alloys is used by different countries for their various denominations of coins. Gold, however, has almost entirely disappeared as a coinage metal and even silver is giving way to base metals such as copper, nickel, zinc, etc., chiefly for economic reasons. Many factors govern the choice of alloy used for minting, the chief ones being :—

(a) the availability and cost of the base metals used in the alloy,
(b) the ease with which the alloy can be processed,
(c) the wearing properties of the alloy,
(d) its appearance and resistance to discoloration,
(e) its security against being counterfeited.

The metals and alloys used at present for the various denominations of Indian coinage are as follows :—

One Rupee, Half-Rupee and Quarter-Rupee	Pure Nickel.
Two Anna, One Anna and Half-Anna	Cupro Nickel (75% Copper, 25% Nickel).
Single Pice	Bronze (47% Copper 2½% Zinc & ½% Tin).

It is important that the copper used in coinage alloys is free from objectionable impurities and experience has shown that the presence of even 0.005% of bismuth is dangerous and may produce unsound ingots. Generally speaking electrolytic copper is preferred to fire-refined.

The use of pure nickel (i.e., nickel not alloyed with any other metal) for coinage purposes is a recent innovation to this country. Owing to its high melting point of 1452° C. and due to the fact that it can only be processed by using very special equipment, nickel coins are difficult to counterfeit. Another distinctive feature of pure nickel is its magnetic quality, and the genuineness of pure nickel coins can therefore be tested by the use of a magnet.

MELTING AND CASTING INTO INGOTS

Melting is carried out in oil-fired furnaces, which are 22″ in diameter and comprise a pre-heater and main chamber. The furnaces are constructed of suitable refractories, the outer lining being of firebrick and the inner lining of silimanite brick coated with patching materials such as Sair-set, Highrate, etc. The two chambers so constructed are encased in a cast iron frame which incorporates a hinged " door " located just beneath the chambers, and which forms the bottom of the furnace.

The charge of approximately 10,000 tolas (250 lb.) is placed in a 300 lb. crucible. The " alligation," which usually is in the form of pure nickel, copper slabs (electrolytic and not fire refined) and " scissel," " ends " and " rejections," is placed in the crucible after placing a small amount of charcoal in the bottom of the crucible. The crucible is not allowed to come into contact with the furnace bottom plate and to facilitate easy removal when it is ready for pouring, the crucible stands on a plumbago block, or a special shaped fire brick, which, in turn, is kept off the bottom plate by a layer of sand. This charge, which takes approximately 4 hours to bring up to its pouring temperature of 1390-1400° C. from cold, is melted in a slightly oxidising atmosphere. In order to improve the ductility of the ingots, a deoxidiser of cupro-manganese (50 tolas for a 10,000 tola charge) together with a small quantity of charcoal, is added when ready for pouring, and the molten mass is then thoroughly stirred with a plumbago rod. The crucible is then removed by an overhead crane and its charge poured into moulds carried on a movable mould truck which produces ingots 22″ × 2″ × $\frac{1}{2}$″. Pouring must be done carefully, at a steady even rate, if good ingots are to be obtained. The moulds, usually cast iron or " meehanite," are previously prepared by heating them to a temperature of approximately 350° C. and coating them with a mixture of kerosene and castor oil, or graphite powder.

After all the moulds in the truck (usually 25 for a 10,000 tola charge) have been filled, the ingots are removed, quenched and

passed to a bar shearing machine, where the heads of the ingots are removed until sound metal is exposed, because owing to shrinkage during solidification, piping and porosity appears in this portion of the ingot. If this was not done, "laminated straps" would result after cold rolling and defective coins would be produced. The sides of the ingots are then cleaned-up on a rotary filing machine, stacked on trolleys and passed to what is known as the "Laminating Department."

In the new Alipore Mint, the furnaces described above will be replaced by the most up-to-date oil-fired hydraulic tilting furnaces of 600 lbs. capacity (for cupro-nickel and bronze melting), and by automatically controlled electric arc furnaces of 15 cwt. capacity for the melting of pure nickel. Cupro-nickel and bronze will be cast into ingots 26″ x 6″ x 1″ and pure nickel into ingots 4″ square and 30″ long. It is important to note that it is much easier to cast a really sound ingot *if the thickness is relatively large compared with the other dimensions.*

The 4″ square pure nickel ingots will be reduced to approximately $\frac{1}{8}$″ thickness on a 3-high cogging and stranding hot roll. The ingots will be heated to the required temperature for rolling in producer-gas-fired batch and billet furnaces of the latest design. Removal of defects and scale will be effected by fettling with a pneumatic chipping hammer and sand blasting.

COLD ROLLING OF INGOTS The $\frac{1}{2}$″ thick ingots for the production of, say, two-anna coins, have now to be reduced in thickness to 0.059″. This is carried out in three stages, viz. :—

(a) Initial breaking down on 18″ diameter rolls.

(b) Further reduction on the intermediate 12″ diameter rolls.

(c) Final reduction and adjustment on the 10″ diameter fine rolls.

In the case of the 2-anna ingot the reductions are effected as follows :—

0.50″ to about 0.070″ in 12–8 passes.

0.070″ to about 0.063″ in 6 passes.

0.063″ to about 0.059″ in 9–12 passes.

During the process of rolling, the length of the "strap" (as the ingot is now called) increases, and has to be periodically cut on a light shearing machine to obtain lengths convenient for handling.

The final adjustment of the straps is extremely important, as blanks cut from the finished strap from anywhere along either edge must not vary in weight more than quarter of a grain. To achieve this degree of accuracy the rolls are touched-up every few hours with wooden wedges powdered with fine emery, and all ridges and irregularities that may have formed on the roll surface are removed. The rolls are also tested daily by passing two short straps through them until the required thickness is obtained. A blank is then

cut out from the centre of each strap and their weights compared. The rolls are then adjusted until blanks cut coincide in weight, or are within a variation of not more than $\frac{1}{8}$ of a grain.

GAUGING AND ADJUSTMENT OF STRAPS A " Gauger " is in charge of each pair of rolls and an occasional strap is gauged up to the fourth pass. After the fourth pass, each strap is gauged in order to avoid light straps being passed on. Final gauging is done by cutting a blank from each strap on a hand-operated dumbbell press, known as the " muster press." Blanks cut from the straps are weighed and if within the limits permissible, the straps are passed on to the " Cutting Department." Straps producing blanks more than one grain heavy are sent to the fine rolls again for final adjustment, while those producing blanks which are too light are rejected. If the gauging has been correctly carried out, light straps are an impossibility, but no matter how carefully the rolling is done and how accurate the rolls may be, there will still be slight variations in the thickness of the finished straps. Consequently, if all the blanks were cut the same size the resulting coins would vary in weight to such an extent that some of them would be beyond the permissible allowance for weight. Each strap is therefore marked in a manner corresponding to the weight of the trial blank cut from it. When the straps are taken to the hand presses for " mustering," a blank is cut out of the strap at a gauged distance so that when the strap later passes through the " cutting " or " blanking " press, the cutting punch will automatically fit into the hole already made. This precaution reduces the production of what are known as " cutting wasters." The straps are marked near the muster holes with the weight of the blanks, as well as the number of the trial hand press at which they were tested. The straps are then sorted out and sent to the cutting presses.

The muster or trial press punches are tested every morning and also during the day against a standard punch. A blank is cut by the punch under trial and one on each side of it, by the " standard " punch of the department. The arithmetic mean of these last two is then taken. If the weight of the blank cut by the punch under trial and the mean of the weights of the blanks cut by the standard punch, vary to the extent of $\frac{1}{16}$ of a grain, the cause of the discrepancy must be removed before work is allowed to proceed.

CUTTING BLANKS Straps received from the adjusting section are taken to those cutting presses which are marked with the same marks as on the straps. The reason for this is that the cutting beds and punches in these machines are varied slightly above and below standard diameter. If, for example, the marking on the strap

indicates that the trial blank is heavy, showing that the strap is slightly too thick, this particular strap is sent to a machine where the diameter of the punch is slightly less than the standard diameter. The blanks cut from it should then be approximately the correct weight. The straps are placed on a table located in front of each press, and are fed forward automatically by means of rollers fixed front and back, and worked from the main shaft of the press by means of a pinion and ratchet.

The " scissel " (which is the name given to the surplus metal as it emerges from the cutting press) drops on to the floor and is broken by hand into lengths of about 14", and tied into bundles of about 500 tolas for re-delivery to the melting department.

The cutting presses run at 140 strokes per minute and blanks are cut two or three at a time, depending upon the denomination. Every morning, each press is tested against a standard punch and only those that are within a plus or minus variation of $\frac{1}{16}$ of a grain are allowed to continue cutting. In addition to this precaution the presses are tested frequently during the day by taking blanks from each of the presses during the course of operations, and weighing them individually. If the weights approximate too closely to the limit specified, the particular press is stopped and re-trial made.

TESTING BLANKS FOR ACCURACY One hundred blanks from each of the presses are weighed at intervals of not less than one hour throughout the day as an indication of the latter's correct or incorrect working, and also for the purpose of keeping the " pressman " informed as to whether the weights of the blanks are within the correct limits. The weight of each batch is recorded in the department and should results vary beyond the permissible limit, two or three straps are taken from the defaulting press and retried in the trial press where they were originally tested. If the weight of the blanks is found to differ from the original mark on the strap, carelessness on the part of either the " weigher " or the " marker " is indicated. If the straps prove correct, the punches and beds are tested and, if at fault, re-ground or changed as found necessary.

EXAMINATION OF BLANKS Blanks are finally examined by passing them over stout wire netting supported on a sheet iron table. Cutting " wasters " are removed by " sorters " or drop through the spaces of the netting on to the table below. The good blanks are pushed down a " chute " into pans from where they are removed, and, in the case of 2-anna blanks, put into bags containing 2,000 pieces and the exact weight of the bags is carefully recorded.

" EDGING " OF ROUND COINS In the case of circular coins such as the rupee, half and quarter rupee, the blanks for these denominations are sent to " edging " machines on which the blanks are made

perfectly circular in shape, and their edges thickened and raised to facilitate the actual coining of the blank at a later stage.

The blanks, which are fed into a hopper, impinge on the edge of a revolving solid steel disc. They are then caught by this disc and pushed down a chute into a space narrower than their own diameter formed between a revolving steel disc (which is about 12″ diameter) and a steel block secured by bolts to the platform of the machine. This space is adjustable, as the steel block can be moved nearer to or further from the disc opposite it.

The steel disc has a groove parallel to its circumference which is the thickness of the blank. The steel block has a similar groove with the same radius. As the blank descends the chute, it is caught in the groove of the revolving steel disc and forced through the space between it and the grooved block. By this means the edges of the blanks are compressed within the grooves in the revolving disc and fixed block, and are thus thickened and raised around the whole circumference of the blank.

Care is taken to maintain an even rounded surface upon the edge of the blank by repeatedly passing a " hob " or " former " (which is a hardened steel disc the size of the finished blank) between the disc and the block. Each edging machine can deal with up to 1,000 blanks per minute.

ANNEALING AND POLISHING OF BLANKS

The process of " rolling ", " blanking," and " edging " causes the alloy to harden to such an extent that it would not be possible for the metal to " flow " correctly under the coinage dies, unless the blanks were annealed before stamping. Furthermore, the percentage of broken dies would be very high indeed. After " edging " in the case of round coins and " blanking " in the case of shaped coins, the blanks are sent to the " Annealing Department " where their hardness is reduced from between 160–180 V.P.N. to between 75–85 V.P.N.

Annealing is carried out in forced-draught, gas-fired rotary furnaces in which a muffle is slowly rotated by a worm gear driven from a line shaft. On the inner periphery of the muffle, there are deep spiral grooves along its entire length. As the muffle slowly rotates the blanks creep along the grooves until they reach the end, where they fall down a chute and into a trough of water. The speed of rotation and the temperature of the muffle are set to suit the particular alloy and size of blank to be annealed. For example, for cupro-nickel blanks, the temperature is kept at approximately 800° C. and for bronze blanks at 500° C. The " soaking " period per charge varies from 16–18 minutes.

The muffles, which are made of a nickel-chrome alloy, are housed in a chamber lined with special fire bricks, in which openings are provided to accommodate eight burners, the flames from which

impinge on to the rotating muffle. The correct adjustment of the burners is of the utmost importance, as too much air results in a discoloration of the blanks, which cannot be entirely removed. These furnaces, which have proved to be very successful for this type of work, have one serious disadvantage, in that the muffles have a very short life (about $1\frac{1}{2}$–2 years) and cost approximately Rs. 13,000 each.

After annealing the blanks are dipped in a weak solution of sulphuric acid and water, washed again in clear cold water and finally polished in " tumbling " barrels, containing nickel shot and a mixture of soda ash, soap and water. They are then dried with hot sawdust, inspected and, if satisfactory, counted, " bagged " and sent to the " Stamping Department " to be turned into coins.

In the new Alipore Mint, the pure nickel blanks will be annealed in electrically heated, automatically controlled continuous belt-type bright annealing furnaces of the very latest design. The rather antiquated method of drying blanks by hot sawdust will be replaced by hot air-drying equipment.

STAMPING OR STRIKING BLANKS

After reaching the Stamping Department, the blanks are again counted and bagged and are then distributed to the coining presses. These presses, which are specially designed for the job, are belt-driven from line shafting and run at a speed of approximately 100 r.p.m.

It is difficult to describe in a few words the mechanism and operation of these presses. However, I hope that this simple description will enable you to understand how the blanks receive their impressions.

The blanks are fed into a chute located above a pair of feed fingers, which reciprocate in a horizontal plane. On the backward movement of the feed fingers, they open and receive a blank. On their forward movement, the feed fingers close on the blank and carry it forward, placing it in position in a collar surrounding a die which " carries " the impression of the reverse side of the coin. Located immediately above the " reverse " or " bottom " die is the " obverse " or " top " die, which " carries " the impression of the obverse side of the coin.

Further movement of the main crankshaft causes the top die to strike the blank, which now receives the impressions of the top and bottom dies.

Immediately after striking, the next movement of the crankshaft causes both the top and bottom dies to move upwards, the bottom die pushing the stamped coin out of the collar. At the precise moment, the feed fingers move into position with the next blank and, in doing so, push the stamped coin off the bottom die and send it down a chute to a receptacle below.

INSPECTION ASSAY AND PACKING OF COINS The stamped coins are now inspected for defects and the good coins are then counted and put into bags or paper rouleaux, and finally packed into boxes for despatch to the various treasuries in India.

It should be mentioned that a certain number of coins known as "pyx" coins are taken at random from each day's output and sent to the Mint Assay Department for assay and weighing. These pyx coins should be within the permissible limits both for fineness and weight and if they fail to do so, the day's output of that particular denomination is rejected.

MANUFACTURE OF DIES For obvious reasons I cannot divulge to the public the methods used by the Mint to produce the "master" die. However, a brief description of the processes involved in the manufacture of the ordinary coinage die might be of interest. You will no doubt appreciate that the production of these dies is a vast and complex subject, necessitating careful control at all stages and that it can only be undertaken by personnel having many years' experience of this specialist work. Good dies are essential for the production of good coins.

The steel used by the Mint for coinage purposes is a 0.9 carbon steel specially produced for the purpose.

This is received in annealed round bars which are cut into small pieces 2 and 3 inches long, known as "die blocks." One end of the die block is turned to the shape of a cone and highly polished and the other end is merely "faced." The angle of the cone is very important and varies according to the denomination of coin to be produced. The object of the cone is to facilitate the flow of the metal when struck in a press. The block is now ready to receive its first blow from the "punch", which is the opposite to a die, in that the design on the punch is in relief, just as it is on a coin, whereas on a die, the design is in intaglio. In other words, the punch is simply a "male" die. The punch, which of course is in its hardened state, has been produced from the master die or "matrix."

The punch is now fitted into a tapered binding ring and placed on the bed of a multiplying press. The die block is also fitted into a binding ring and held in position above the punch. A blow of approximately 120 tons per square inch is then given, the cone flattens out appreciably and receives the impression from the punch. The first impression is by no means perfect and at least another three to four blows have to be given before the design is fully "made" or "up." After each blow the die block has to be annealed in order to soften it and relieve the stresses which have been set up in the metal.

The die is then positioned, face downwards, in a ni-chrome annealing pot, packed in warm animal charcoal, sprinkled with

quicklime and placed in a furnace where the pot and its contents are slowly brought up to a temperature of approximately 640° C. After the soaking period (which varies from 2–3½ hrs., according to the size of the die) is over, the pot is allowed to cool slowly in the furnace overnight. After each anneal, the die is cleaned with hydrochloric acid, washed in clean water and carefully inspected to see that no cracks or other defects have developed. It is then sent along to the Artist Engraver of the Mint, who touches up the impression, if necessary, in much the same way as a photographer touches up a portrait. After the final anneal, the die is machined to the required shape and " normalised." Normalising is practically the same as annealing, except that the soaking period is reduced and the pot is cooled in air instead of in the furnace. The die now receives its final " touching-up " from the Artist Engraver.

At this stage it is ready for hardening, a heat treatment which is very similar to annealing, except that the furnace temperature is higher (760°–780° C.) and instead of being allowed to cool down slowly, the die is rapidly removed from the furnace, and with the aid of a pair of copper tongs, is plunged between two jets of water, the temperature of which is maintained at 65° F. Whilst the die is between the jets, it is moved about so as to prevent formation of steam bubbles which cause soft spots on the die surface. The die is now extremely hard—in fact, too hard for coinage purposes, as it would undoubtedly crack if it was used without being " tempered ". Tempering is effected by placing the die in an electrically heated oil bath and heating it at a temperature of approximately 200° C. for a certain time, depending upon the size and shape of the die (½–¾ hr.). After hardening, the dies are cleaned, first with petrol and then with hydrochloric acid and finally in clean water, and sent for final inspection and polishing to the Engraving Department. Dies are expensive items and therefore a very careful record of their performance has to be maintained. A good pair of dies will stamp 100,000 coins before needing rejection due to excessive wear or cracking. Every process involved in the production of dies, therefore, has to be very carefully supervised and thorough inspection at each stage of manufacture is *absolutely essential*.

CONCLUSION.

I think you will agree that " making money " is a fascinating subject from any point of view. The actual manufacture of coins is certainly interesting and from these notes you will no doubt appreciate the very large number and wide varieties of processes involved. Each process has to be very carefully controlled, so that

defective work is rejected at the early stages. Accuracy is most important, as this, together with a high quality finish, makes the work of the counterfeiter more difficult. Competition from the public must not be encouraged in any way !

Each denomination of coin creates its own manufacturing problems, and it is of interest to note that in spite of all the experience and knowledge of minting which the Mint has at its disposal, a coin of new design can only be mass produced satisfactorily after several weeks, and sometimes months, of experimenting. Due regard has to be given to quantity, quality and cost, and Minting, therefore, is truly a job for the Production Engineer.

THE DEVELOPMENT, PRODUCTION AND MANUFACTURE OF ELECTRO-TINPLATE

By W. E. Hoare, B.Sc. (Eng.), F.I.M., A.I.Prod.E.

THE traditional method of applying the tin coating of tinplate is by immersion of the steel basis sheets into a bath of molten tin. This was the process used in Bohemia in mediæval times and introduced into this country by Andrew Yarranton in the 17th century. The hot-dipping process, as it is called, is now carried out in tinning units of modern engineering design and relatively high speed, but the essential principles and metallurgy of the process remain the same.

The long and continued use of the dipping process rests on sound foundations. As a conversion operation it is straightforward ; plant is not high in first cost or maintenance, and is flexible both in regard to type and magnitude of output. The procedure is well-suited to the coating of steel in sheet form and the product has proved broadly suitable for the diverse uses and duties to which tinplate is put. Offsetting these valuable characteristics, however, the hot-dipping process as it is generally practised does exhibit three features which have affected its recent development in comparison with the newer electrolytic process. Firstly, it has not been found to be immediately adaptable to the coating of strip in long continuous lengths ; secondly, it cannot conveniently produce tin deposits consistently less than about 0.00007 in. in thickness ; and thirdly, the coating thickness may in certain circumstances vary rather widely from the nominal or required thickness. As will be seen, these points have had a somewhat important bearing on recent development trends.

TWO IMPORTANT DEVELOPMENTS

During the past twenty years there have occurred in the tinplate industry two events which have greatly altered the course and complexion of manufacture. The first event was the introduction of the continuous cold-reduction process for making the steel base of tinplate. As distinct from the old-established hot-pack rolling process which produced tinplate base in separate sheets of about 20 in. by 30 in. dimensions, the newer method, by which nearly all the world's

tinplate base is now made, produces the basis stock in a continuous coil or band of steel about 36 in. width and upwards of three miles long.

The second event was the loss to the Allied Nations of the tin-producing areas of the Far East during the Second World War. This loss, fortunately temporary and now more than made up, caused an imperative and urgent need for tin economy during the early nineteen-forties.

Development of the continuous cold-reduction process for tinplate base was a legitimate and fundamental advance in the technology of manufacture. The improved physical characteristics and better corrosion resistance of the material opened up many fine possibilities for new container products and canning ventures, and at the same time caused the tinplate manufacturers themselves to consider what they might do to make their final coating process applicable to continuous bands of steel instead of to separate sheets. Already, in the few years before the war, investigations were in hand on both the electrolytic and hot-dip tinning of strip and some promising results had been obtained with both methods. If this situation had developed along normal lines it would seem highly probable that a steady development of both procedures would have ensued, but in 1941 the spanner of tin shortage was thrown into the works. Attention was then turned almost exclusively to the development of the electrolytic process, because of its known ability to produce very thin coatings. It was considered that its adoption would enable industry to tide over the shortage and maintain supplies of plate even if long-established standards of quality had to be somewhat eased and written down.

The challenge was admirably met by American industry and the curve of advancing electro-tinplate production forms an almost unparalleled example of rapid industrial development. The process is a complex welding together of engineering, chemical and electrical technology and yet in about a decade it progressed almost from the beaker on the laboratory bench to million-ton production (Fig. 1).

Although intensive development did not start until 1941, one must not forget the valuable exploratory work which preceded this. In the nineteen-thirties research men in England, America and Germany were studying the fundamentals of tin-electrodeposition and still-plating of articles was a satisfactory and commercial *fait accompli*. Indeed, the history of tin-electrodeposition itself goes back eighty or a hundred years and for those who may be interested papers by Paul Pine[1] and S. Baier and R. M. Angles[2] may be recommended. On the continuous plating of strip, work was carried out on narrow widths in Germany and resulted in some commercial development. In 1936/37 the Carnegie-Illinois Steel Company's

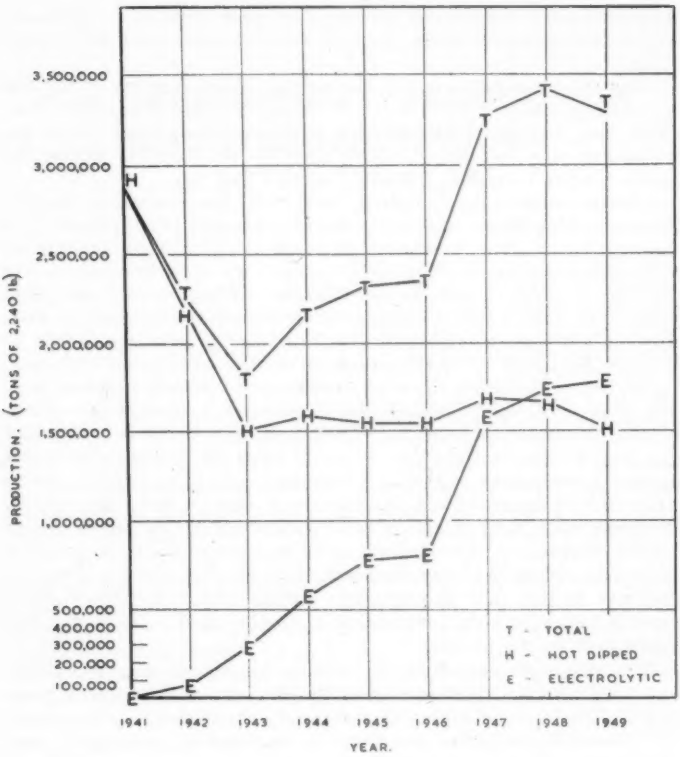

Fig. 1. Tinplate Production in U.S.A.

Gary works had a 32 in. wide pilot line working and the Crucible Steel Company also had a 20 in. line working at Midland, Pennsylvania. Production of these two lines, however, only totalled probably about 60,000 tons a year and in 1942, when the trigger of intensive development was pulled, Tom Lippert of " The Iron Age " was moved amusingly to write :

" Only a few months ago electrolytic tinplate's father spoke of him almost with apologetic reluctance, but to-day a variety of fathers, godfathers, foster-fathers and miscellaneous consorts coo and goo and march him proudly down the avenue."

So effective was the impact of their parental pride that in about five years' time there were over 25 full-scale electrolytic lines working. More recently, a line has been put in at the Ebbw Vale works of Richard Thomas and Baldwins, Ltd., two fast lines have been installed in Canada, and a very high-speed line in W. Virginia, of which more later. Next year at least three more lines will come into operation, two at the Trostre works of the Steel Company of Wales, and one at the Liège works of Ferblatil in Belgium.

REQUIREMENTS OF AN ELECTROLYTIC LINE

Before any detailed description can be attempted, it is desirable to get a clear pre-picture of what an electrolytic tinplate line is called upon to do. Generally a line comprises a series of processing units all connected in tandem and running synchronously together. In passing through the line the strip is de-coiled, its leading end welded to the trailing end of the coil ahead, and its surface is cleaned, pickled and plated with the required thickness of tin. It is then rinsed, the coating brightened by momentary fusion of the tin, and filmed to improve lacquering quality. The strip is finally oiled, sheared into sheet lengths, classified and piled.

The plant must be capable of handling strip through all these operations at speeds of 500 ft. per minute or more, in order that capacity shall bear a good economic relation to the capital investment involved in these large and complex installations.

PLATING ELECTROLYTES

In considering the design and operation of electrolytic lines, it is necessary to give a little time to discussion of the properties of the various electrolytic baths that are used. As will be seen, the plating characteristics really determine the broad shape of design. For example, the current density plating range will determine the amount of D.C. power required, and the immersed length of strip in the plating section for any required speed. The D.C. load may determine heat-exchange capacity. The nature of the electrolyte will also affect choice of materials of construction for the plant, and perhaps also the design of ventilation systems. It will, therefore, be convenient to consider briefly the following essential features of currently-used electrolytes : plating current density, working temperature, valence of the tin ions, and chemical nature of the solution.

At the present time there are four plating electrolytes used in electro-tinplate manufacture. These are :

1. The stannous phenolsulphonate bath.
2. The Halogen bath.
3. The sodium stannate bath.
4. The potassium stannate bath.

THE STANNOUS PHENOLSULPHONATE BATH This electrolyte was developed by the Carnegie-Illinois Steel Corporation. It has been called by them the Ferrostan bath, a name which has the advantage of being shorter and more pronounceable than the scientific one in the sub-heading. The electrolyte is essentially a solution of stannous tin in phenolsulphonic acid, to which an organic " addition agent " is added to promote the formation of smooth, compact and " brightenable " deposits. This electrolyte plates tin from the lower valence or stannous ion and thus requires less D.C. power than electrolytes which plate from the higher valence or stannic ion. The electrolyte is characterised by high electro-chemical efficiency, that is, one obtains as much plated metal for a given amount of electricity as one would expect from Faraday's Law. It is capable, and this is very important, of producing good deposits at high current densities without loss of efficiency or difficulties with anode behaviour. Working current densities of 250 ampères per sq. ft. and upwards can be and are employed. The electrolyte can be worked cold, but efficacy is improved at temperatures 20° to 25° C. above ordinary ambient temperature. The electrolyte is an acid solution and corrosive to usual materials of construction ; lining and protection of tanks and equipment is usually necessary.

THE HALOGEN BATH The halogen electrolyte was developed by the Dupont Company. It consists of a solution of tin halides (chloride and fluoride) at a concentration of 2 to 5 oz. of metallic tin per U.S. gallon, and contains about 0.25 oz. per gallon of an organic addition agent to promote the deposition of smooth compact deposits. The best operating pH is about 2.7 and optimum temperature 65° C. (150° F.). Like the phenolsulphonic acid bath, it plates from the lower valence tin ion and is characterised by high electro-chemical efficiency (better than 97 per cent.). Very high cathode current densities are possible without loss of efficiency or other plating difficulties. Anode behaviour is good and anode current densities up to at least 500 ampères per sq. ft. do not give any polarisation troubles. The electrolyte is corrosive and protection of ordinary materials of construction is required.

THE SODIUM STANNATE BATH This electrolyte has been used for some years for still-bath job-plating, but its application to high-speed strip plating was pioneered by the Crown Cork Company. The sodium stannate bath is markedly different from the two electrolytes described above. It is an alkaline solution of sodium stannate containing about 12/25 grams per litre of free sodium hydroxide and 35/50 grams per litre of metallic tin.

No organic addition agents are used. Operating temperature is about 90° C. (105° F.). The stannate electrolyte plates from the higher valence or stannic tin, and on electro-chemical grounds requires twice as much D.C. power per unit of tin plated as do the Ferrostan or Halogen electrolytes.

In actual practice, D.C. power requirements are *more* than double due to high ohmic resistance of the stannate solution and, in certain cases, lower plating efficiency. In a straight stannate bath, cathode current efficiency will be around 90% (Sn^{iv}) but efficiencies higher than this may be achieved, without any adverse effects, if stannous tin is present in the electrolyte. Cathode current density does not normally exceed 50 ampères per sq. ft., which means that a longer plating pass-line length is necessary in order to work at good speeds. The electrolyte is substantially non-corrosive and un-lined mild steel equipment can be quite freely used in plant construction.

THE POTASSIUM STANNATE BATH

This electrolyte, introduced by Metal and Thermit Corporation, is similar in many respects to the sodium stannate bath, being in effect a potassium hydroxide solution of potassium stannate. The use of the potassium ion yields a higher cathode current density plating range and higher electrolyte conductivity. Lowenheim* gives the following figures for a high speed plating bath :

Potassium stannate 375 grams per litre (≡ tin 142 grams per litre), free KOH 15/23 grams per litre, temperature 160/200° F. (70/94°C.) cathode current density 250 ampères per sq. ft.

An early disadvantage of the potassium stannate bath was that improvement in cathode behaviour was not paralleled by a commensurate improvement in anode de-plating range. It is now claimed that this disadvantage is overcome by the use of tin anodes alloyed with a very small quantity of aluminium (U.S. Patent 2,458,912) or sodium (U.S. Patent 2,432,718).

DEPOSITION CONDITIONS

The conditions of deposition common in electro-tinplate practice are very different from those generally familiar to the still-plater. Still-bath plating, for normal protective and decorative purposes, is characterised by current densities around say 20 ampères per sq. ft., plating times of the order of half an hour and thicknesses of half to one thousandth of an inch. In electro-tinplate practice, current densities may be in the range 200/500 ampères per sq. ft., plating times a few seconds and thicknesses around thirty millionths of an inch.

For reasons best known to itself, the tinplate industry uses a unit of production called the *basis box* or *base box*. This is a unit

of sheet area equal to 31,360 sq. in. or 217.8 sq. ft. Thicknesses of tinplate coatings are always expressed in pounds or ounces per basis box and it is useful to bear in mind the following conversions:

(1) 1 lb. or 16 oz. per basis box = 0.00006 in. thickness of tin on each face of the sheet.

(2) 25 basis boxes weigh about 1 ton (this latter figure is only a weighted average since the conversion depends on gauge).

A few simple formulae may assist us in appraising the performance of electro-tinplate lines.

$$\text{Tin deposited in ounces per basis box per minute} = 0.567 \times \text{C.D.} \times \eta \quad \ldots\ldots(1)$$

Where C.D. = cathode current density in amperes per sq. ft.
η = efficiency.

$$\text{Tin deposited in ounces per basis box} = \frac{0.567 \times \text{C.D.} \times \eta \times L}{s} \quad \ldots\ldots(2)$$

Where L = length of strip in the plating bath in feet
s = speed in feet per minute.

$$\text{Plating time for any unit of strip} = \frac{60L}{s} \text{ seconds} \quad \ldots\ldots(3)$$

$$\text{Line production in basis boxes per 8 hours} = 2.2 \times s \times w \quad \ldots\ldots(4)$$

Where w = the strip width in feet.

$$\text{Line production in tons per 8 hours} = 0.0885 \times s \times w \text{ (approx.)} \quad \ldots(5)$$

These expressions are calculated for deposition from the stannous tin ion, as is the case in acid baths. For alkaline baths, depositing from the stannic ion, the electro-chemical equivalent is halved and the appropriate expressions must be divided by 2.

Examples. Taking a stannous phenolsulphonate bath working at 600 ft. per min. with a current density of 210 ampères per sq. ft., a plating pass-length of 40 feet, a strip width of 30 in., and at 98% efficiency.

(1) Tin deposited per basis box per minute $= 0.567 \times 210 \times 0.98$
$= 116$ ounces

(2) Tin deposit on strip $= \frac{0.567 \times 210 \times 0.98 \times 40}{600}$
$= 7.75$ ounces per basis box

(3) Plating time $= \frac{60 \times 40}{600}$
$= 4$ seconds

(4) Line production $= 2.2 \times 600 \times 2.5$
$= 3{,}300$ basis boxes per 8 hours
$= 133$ tons approx.

FERROSTAN LINES

The Ferrostan electro-tinplate line, originally developed by the Carnegie-Illinois Steel Corporation, is the most widely used type of plant for electro-tinplate production to-day. There are thirteen lines working in the U.S.A., two in Canada, and one here in this country. Moreover, at least three more plants will be operating in Western Europe soon.

Installations vary in details of design, and newer plants may be faster and more highly-powered than earlier installations. The general lay-out of all lines is, however, broadly similar and a typical arrangement is sketched in Fig. 2.

At the entry end of the line there are two pay-off reels, an end-squaring shear, a welder, a pinch roll, a deep looping pit, and an entry drag-bridle. These units serve, in the following way, to feed a continuous band of steel strip into the coating section of the line. The leading end of a new coil is trimmed square by the shear and inched up to the welding station, where it awaits its turn to enter the line. When the trailing end of the previous coil flips off the reel, the pinch rolls are slowed and the end brought up to the shear, stopped, trimmed square, inched up to the welder and seam-welded on to the new coil. The pinch rolls are then speeded up and strip from the new coil proceeds through the line. The looping pit, which is sufficiently deep to accumulate 100 to 200 ft. of strip, permits the tinning line to operate continuously in spite of the necessary 10 to 15 seconds stop at the entry end for shearing and welding.

After passing through the entry bridle, which is essentially a pull-back device to facilitate accurate tracking, the strip enters a series of three vertical cleaning tanks for electrolytic cleaning and pickling. These tanks normally have an effective depth of about 7 ft. and are equipped with guide rolls at top and bottom. On some of the new, faster lines effective depth will be increased to about 8 ft. Of the three tanks one is fitted with steel anodes and charged with dilute alkali ; the second is used as a rinsing tank, and the third is equipped with steel and lead electrodes and charged with dilute sulphuric acid. In the first tank the strip is cleaned by cathodic treatment at current densities of the order of 100 ampères per sq. ft. Specially compounded alkali cleaners, typically mixtures of sodium hydroxide and trisodium phosphate, are used in a concentration of a few pounds per 100 gallons. Electrolyte temperature is maintained at about 95° C.

After rinsing and brushing in the second tank, the strip passes to the third tank where it is electrolytically pickled and etched in dilute sulphuric acid at current densities of 50/100 ampères per sq. ft. Arrangement is usually made for both anodic and cathodic pickling, polarity of the strip being of opposite sign in the down-

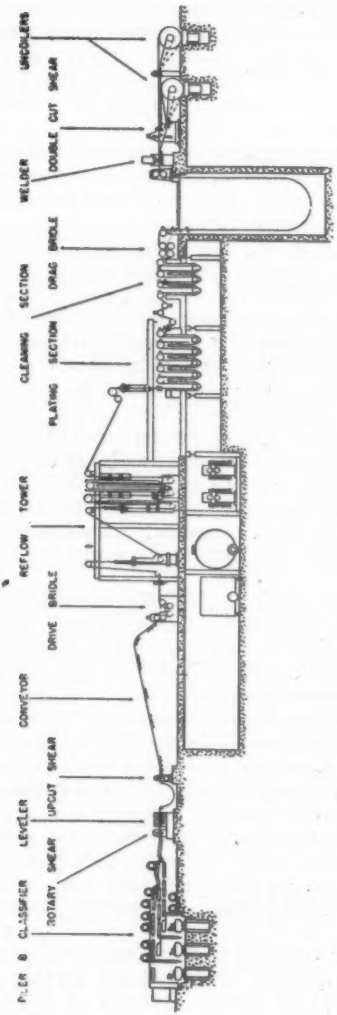

Fig. 2. Sketch of Ferrostan Electrolytic Line.

going and upcoming legs. When the strip is anodic, the cathodes are steel; when the strip is cathodic, the anodes are lead. In some cases, however, only anodic pickling is given. The acid, usually of 8/10% concentration, does not require heating to 90/95° C., as in direct immersion pickling, and temperatures around 25° C. are usual.

Fig. 3. View taken between two conductor rolls in plating section of a Ferrostan Line.
(*Courtesy Wean Engineering Co. Inc.*)

After pickling the strip is thoroughly rinsed and scrubbed and then enters the plating section. This comprises four rubber-lined steel tanks very similar in size and construction to the tanks of the cleaning section. The tin anodes, in the form of rectangular bars

about 6 ft. long by 3 in. wide, are suspended closely adjacent to each face of each leg of the strip. There are thus four anode bars and four banks of anodes in each tank (Fig. 3). The method of loading anodes is to insert a new one at one side and remove a worn one at the other. In order to compensate for loss of thickness, the suspension bars are toe-ed in towards the strip so that the ionic path is constant across the strip width. The anodes are also sloped vertically in towards the bottom of the vertical pass of the strip to compensate for the IR drop between the top conductor roll and the lowest point of the strip.

The conductor rolls comprise a chromium-plated copper shell mounted on a copper shaft, with current collector rings at each end (similarly in the cleaning section). Sunk rubber-covered guide rollers at the bottom of the tanks are equipped with special spring-loaded shaft seals to prevent loss of electrolyte and seizing.

A common length of plating pass in Ferrostan lines is about 40 ft., or on newer lines 50 ft., in eight or ten legs of 5 ft. each. The actual surface area in the pass at one time is, of course, double this and on say, 34 in. wide strip, this amounts to a plating area of 227 sq. ft. At a speed of 550 ft. per min., an 8 oz. coating would be deposited at a current density of about 200 ampères per sq. ft. and a total D.C. load of 45,000 ampères.

Total D.C. capacity on Ferrostan lines will be of the order of 45,000 to 60,000 ampères at 12/16 volts. Most usually this is supplied by M.G. sets, but two lines in building will derive their power from selenium rectifiers.

The electrolyte is an acid solution of stannous phenolsulphonate containing 30/40 grams per litre of metal, and a small but very important addition agent called phenone. The electrolyte, kept under rigorous control by constant chemical tests and Hull cell plating tests, is continuously pumped into the tanks from the main storage tank. Temperature of operation is around 40/50° C. To maintain the required operating temperature is more a question of cooling than heating, due to the large amount of electrical energy dissipated in the electrolyte. Water tube heat-exchangers are used for this purpose and a good supply of cool water is a very useful thing to have around an electro-tinplate line.

On leaving the plating zone, the tinned strip is rinsed with condensate water and dried. Dragged-out electrolyte diluted with rinse water is handled in a separate pumping circuit and in turn returned to the main storage and pumping circuit. Solution concentration is held constant by vacuum evaporation.

The plated strip, presenting a matt white surface, now passes to the flow-brightening furnace where the tin coating is raised to a temperature just above its melting point and immediately quenched. This treatment renders the tin surface mirror-bright and also

improves the soldering quality of the tinplate. A number of methods are used for the delicately controlled heating required, but on Ferrostan lines resistance heating is most commonly employed. The strip passes under a conductor roll at the base of the melting tower, upwards about 20 ft. to a non-conducting roll at the top and down again to the second conducting roll in the quench tank at the bottom. Heating is provided by transformers connected through an automatic control circuit to the bottom conductor rolls. The input of power is so controlled that the tin coating actually melts as the strip comes down the tower.

FILMING AND OILING

The chemical filming treatment which follows flow-brightening imparts to the tin surface a relatively impervious but invisible oxide film, which improves its tarnish resistance and lacquering qualities. The filming medium is 1% chromic acid applied to the strip by spraying and immersion. Excess acid is removed by condensate spray and the strip is dried before it passes to the last surfacing operation, namely oiling.

The oiling operation, wherein the strip is given a very light coating of cottonseed oil to assist handling in fabrication operations, may come before (always nowadays) or after the main drive bridle which pulls the strip through all the units between it and the back-pull bridle behind the entry looping pit. Oiling is carried out by spraying a cottonseed oil-water emulsion on to the strip and drying out by steam and hot air.

The exit-processing units, wherein the strip is sheared to tinplate lengths, inspected, weight-classified, and piled, is pure mechanical engineering of the highest order, but not requiring detailed description here. It is, however, worthy of note that the flying shears which are used on these lines are capable of cutting sheets of very light gauge at speeds even exceeding 600 ft. per minute.

The main control panel of a Ferrostan line is shown in Fig. 4.

THE No. 4 HALOGEN LINE AT WEIRTON

An installation recently brought into operation at the Weirton Steel Company's West Virginia Works is the newest example of the horizontal three-decker type of line and is, incidentally, the largest and fastest electro-tinplate line in the world. The writer had the opportunity to view this plant at the beginning of the year, just before it went into operation, and it is certainly an impressive piece of equipment (Fig. 5).

Capacity of the line is scheduled at 5,000,000 basis boxes annually, which on a conversion figure of 24.9 basis boxes per ton, gives a tonnage figure of some 200,000 tons a year. According to the

Fig. 4. Control panel for Ferrostan line. This is the main control panel in the electrical basement. Local control panels are situated on the line side.
(Courtesy Wean Engineering Co. Inc.)

thickness of tin coating being deposited, operating speeds up to 2,500 feet per minute are possible.

The line is equipped with two decoilers at the entry end, capable of handling prepared coils of temper-rolled strip up to 14 or 15 tons weight and say 34 in. wide. The decoilers are followed by a squaring trip shear and welder wherein the leading end of a new coil is trimmed and welded on to the trailing end of the strip in the line. An 80 ft. deep looping pit provides the necessary accumulation of travel length to avoid stopping the strip during welding, which in any case only occupies a few seconds.

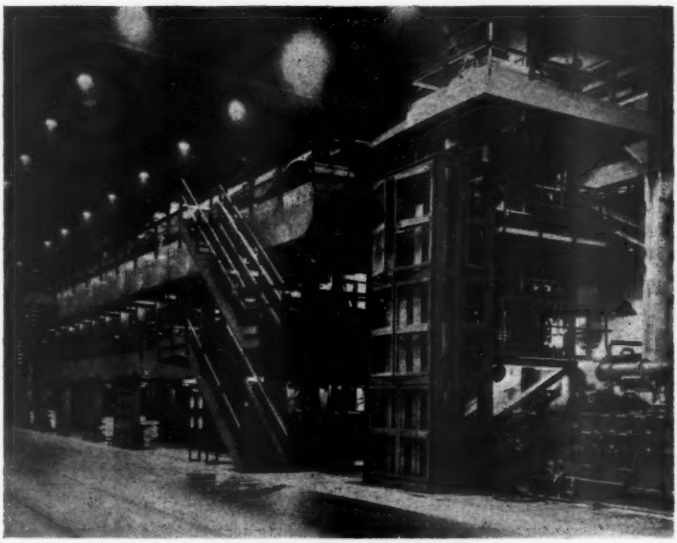

Fig. 5. General view of No. 4 Halogen line at Weirton Steel Co.
(*Courtesy Weirton Steel Co.*)

After passing through the main drag unit the strip enters a single-pass horizontal electrolytic cleaning line, the tank of which is 50 ft. long. In this unit any residue of oil or other surface contaminants are removed by alkaline electrolysis. The four sets of electrodes, connected to 3,000 ampère, 16 volt D.C. generators, are alternately negative and positive. This causes the strip to act as a bipolar electrode and obviates the need for any direct electrical contact to the strip itself. The scrubbing unit follows wherein the strip is subjected to the combined action of 12 in. diameter brushes revolving at 3,000 r.p.m. and high pressure water sprays. This unit is 20 ft. long.

The pickling tank is 100 ft. long, 3 ft. deep and 4 ft. wide and lined with rubber and acid-resistant brick. The pickling solution is 8 per cent. (wt.) H_2SO_4 steam-jet heated to 180° F. On leaving the pickle tank, the strip is squeegeed, rinsed, scrubbed and squeegeed again before it enters the lower deck of the plating unit.

The plater itself is a three-decked 100 ft. long structure and the effective length of plating travel line is about 144 ft. Essentially

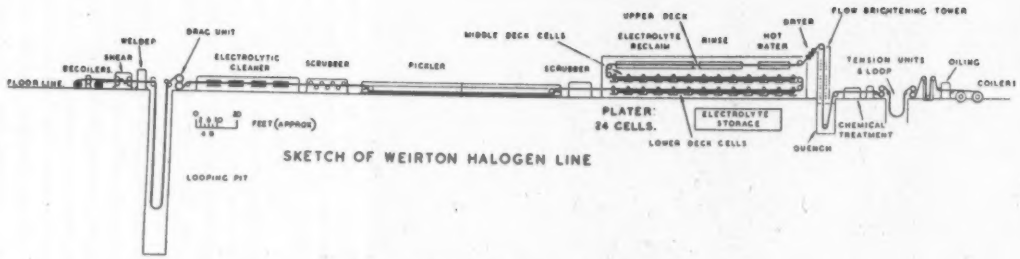

Fig. 6. Sketch of Weirton Halogen line.

it consists of a series of horizontal plating cells or trays each 6 ft. long by 5 ft. wide and 12 in. deep, through which the strip passes. There are 12 cells on the lower deck and in passage through these the underface of the strip receives its tin coating. It then reverses its direction of travel, and passes over the 12 cells of the middle deck to receive the coating on the opposite face. It then turns again to its original direction and passes over the upper deck where dragged-out electrolyte is reclaimed and the plated strip thoroughly rinsed. A sketch of the plant is given in Fig. 6. This is diagrammatic only, but indicates the essential details of lay-out.

Each cell is connected to a 7,500 ampère, 18 volt D.C. generator the current being led away from the strip by means of pairs of contact rollers between the cells. The bottom roll of each pair is rubber-covered and sprung upwards against the steel upper roll. This roll has a copper commutator at each end with carbon-brush contacts leading to the negative bus-bar.

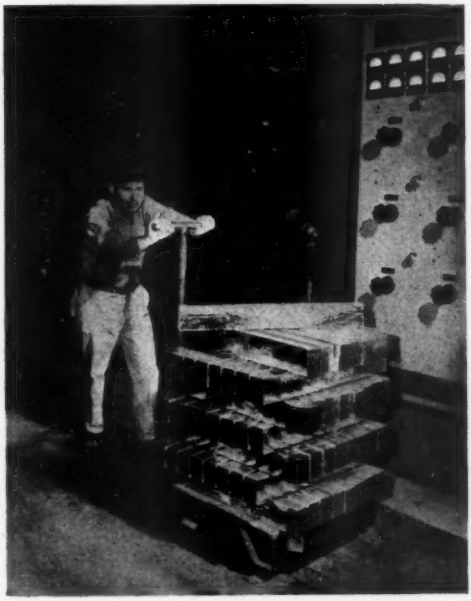

Fig. 7. Tin anode castings.
(Courtesy Weirton Steel Co.)

The anodes (Fig. 7) which are rectangular blocks of pure tin 2 ft. 6 in. long by about 3 in. square, are supported on a bed so that the upper faces are about $1\frac{1}{2}$ in. from the strip surface. Each cell contains 30 anode bars in two beds of 15 each. The operative anode area is thus 5 ft. by 3 ft. 9 in.

The electrolyte is continuously pumped into each cell from a 15,000 gallon storage tank underneath the plater. Solution level in the cells is maintained at strip level by sealing the exit ends and permitting overflow into the collector trays at the entry ends. The clearance between the strip and the edge of the cell at the entry end is only $\frac{1}{8}$ in. A diagrammatic sketch of a cell is shown in Fig. 8 and a general view in Fig. 9.

The inter-cell rollers are all driven synchronously with the main drives and, by electrical linkages, the plating current is automatically matched to the line speed at any moment so that the desired thickness of tin is accurately deposited. Moreover, if the load on one cell falls off, due to say, an increase in internal resistance, other cells will pick up the load until the fault is rectified.

Leaving the second deck, the strip is now plated with tin on both faces and is returned to its original direction of travel to pass over the upper deck. Here, dragged-out electrolyte is wrung off and returned to the storage tank, the strip surface rinsed, given a hot water dip, and dried by hot-air blasts.

FLOW-BRIGHTENING OPERATION

The next step in the operation is flow-brightening, which in this plant is carried out by high frequency induction using 200,000 cycle current at 17,000 volts. The flow-brightening furnace is a tower which rises to a height of 28 ft. above floor level and extends to the water quench tank 17 ft. below floor level. The high-frequency field is generated by series of rectangular coils of $\frac{1}{2}$ in. copper water-pipe which surround the strip as it descends through the tower. Control of this operation is very precise, since the coating must be raised to a temperature only a little above the melting point of tin ; also the time during which the coating is actually molten must be extremely short to avoid reducing its protective value. This involves an intensely concentrated inductive field at the high speeds employed.

The strip now presents the familiar bright appearance of tinplate but two further operations are required before it is finally coiled. First it is passed through a chemical treatment tank where a thin invisible protective film is produced on the surface. In this process the strip is made cathodic in an alkaline chromate solution at a current density of about 40 ampères per sq. ft. Again the strip is thoroughly washed and dried and enters the main tension unit which does the work of pulling the strip through the cleaner, pickler and plater.

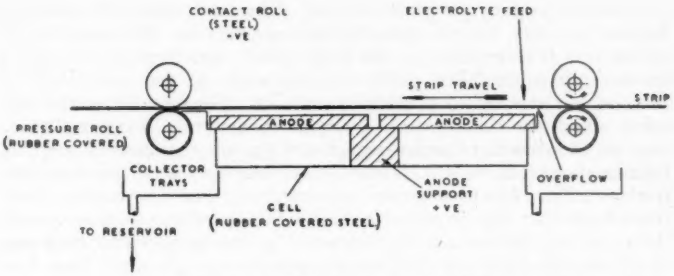

Fig. 8. Sketch of cell : Halogen line.

Fig. 9. Loading of new anode into a Halogen line plating cell.
(Courtesy Weirton Steel Co.)

A small looping pit precedes the oiling unit wherein the strip is given a very thin coating of cottonseed oil. The method of doing this is interesting. The strip passes downwards through a vertical chamber filled with a cottonseed oil fog produced by blowing air through a body of warm oil. The density of the fog, upon which the thickness of oil deposited depends, is controlled by varying the amount of vapourising air. Opposite each face of strip are frames about 5 ft. by 3 ft. across which fine steel wires are stretched horizontally. The frames are connected to a 50,000 volt source and impart to the fog particles a high voltage charge which causes them to be electrostatically attracted to the strip. The thickness of oil deposited is controlled at one-quarter of a gram per basis box or about half a millionth of an inch.

On this line the speeds employed are too great to allow of in-line shearing to tinplate lengths. Accordingly the finished tin strip is coiled and sent to separate cut-up lines of which this plant is equipped with seven (Fig. 10). On these lines the strip is cut to the required length, inspected, weight-assorted, classified and piled.

Fig. 10. High speed cup-up lines for processing electrolytic tinplate in coil. (*Courtesy Weirton Steel Co.*)

Successful operation of a line of such size and speed as this depends on the strictest and most precise control and synchronisation of all operations. The electrical, mechanical and electrolytic control gear and equipment is something on which no expense has been spared. An idea of the problems which have been solved may be gained by consideration of some of the operation times implicit in a speed of say 2,000 ft. per minute. Each unit of strip surface is in the cleaner for only 1½ seconds ; in the pickler 3 seconds ; in the plating cells 4½ seconds (each face 2¼ seconds); in the melting furnace about 1 second and actually in the molten zone for a mere fraction of a second.

ALKALINE LINES

A sketch of an alkaline stannate plating line is shown in Fig. 11. It will be observed that there are certain non-fundamental differences between this line and the ones previously described such as the use of up-run multiple loopers instead of pits, and the absence of an electrolytic cleaning step in the line. The fundamental difference is, however, in the length of the plating pass line which is of the order of ten times that of a usual acid line. It has already been pointed out that this increased plating length is made necessary by the lower current density plating range of straight sodium stannate electrolytes.

The installation comprises the usual entry-processing units which are followed by an immersion pickling tank through which the strip passes in a serpentine manner under and over a series of rubber-covered steel rollers. The practical pass-line length for pickling will be 150-190 ft. and inhibited sulphuric acid of 3-5 per cent. (wt.) concentration is used. The amount of pickling is usually controlled by the temperature of the acid, lower temperatures being used for higher phosphorus steels. Average temperature, however, centres around 75° C. (150° F.).

After thorough rinsing the strip enters the plating tank, which is an unlined steel vat about 50 ft. long by 4 ft. 6 in. wide by 10 ft. deep. There are 24 steel guide and contact rollers at the top of the tank (Fig. 12) and 25 rubber-covered steel sinker rolls at the bottom. The serpentine pass provides 48 vertical strands of strip which, bearing in mind the immersed length of the anodes, means an effective plating pass of about 350 ft.

The anodes, of which there are 48, are massive tin castings typically 8 ft. long by 4 in. thick by 2 ft. 4 ins. wide (1¼ tons). They are connected in groups of six or eight to the D.C. bus-bar. Current from the strip is picked up by the steel contact rollers and taken off by contact shoes on the roller necks.

The electrolyte, steam-coil heated to an operating temperature of 90-95° C. (200° F.), is pumped from the storage tank to the plating vat and filtered on the return journey. The electrolyte reclaim and

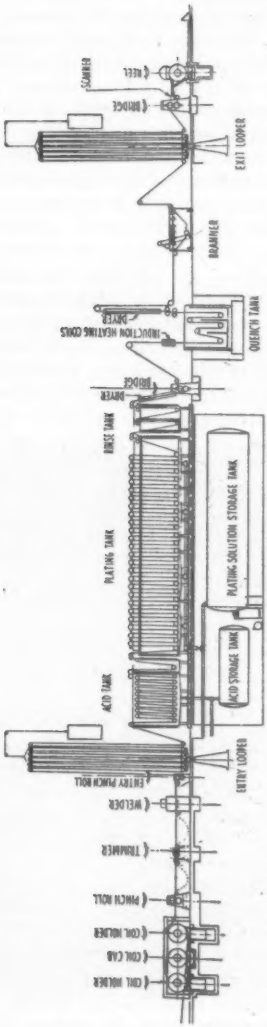

Fig. 11. Sketch of sodium stannate plating line. *(Courtesy Wean Engineering Co. Inc.)*

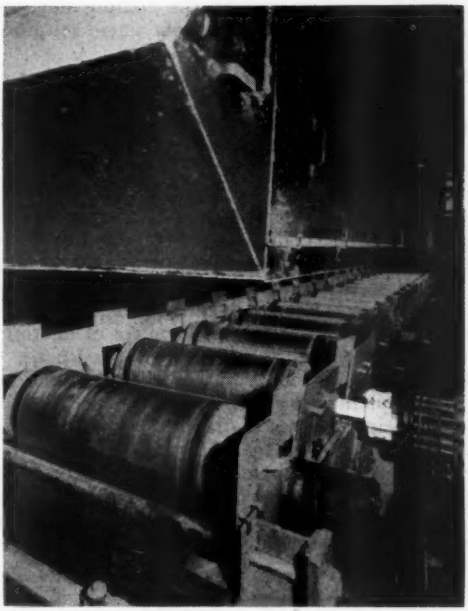

Fig. 12. View across top of plating section of alkaline line.
(*Courtesy Crown Cork & Seal Co.*)

strip-rinsing station at the exit end of the plating vat provides water to compensate for evaporation losses. After the first distilled-water rinse the strip is finally washed with hot water and dried.

On alkaline lines the procedure for flow-melting varies. In some cases the melting tower is in tandem with the plating line ; in other cases separate units are used. One installation of the latter type has three stannate lines working at about 600 ft. per min. followed by six flow-brightening lines which operate about 300 ft. per min.

In this case the plated strip is cathodically cleaned in hot trisodium phosphate solution, rinsed and then passed into a vertical radiant-tube heating furnace. The tower is 44 ft. high and consists of two refractory-lined chambers with a 36 in. diam. water-cooled steel roll above the dividing line. The strip passes up the first vertical chamber, where it is preheated, over the top roll, and down through the second chamber. Herein the temperature is rapidly boosted to

just above 232° C. and as soon as the coating flows the strip is quenched in warm water or dilute chromic acid solution in a tank which seals the bottom of the down chamber.

Chemical treatment, oiling, cleaning and classifying are carried out by broadly conventional methods.

Flow-brightening may also be carried out by high-frequency induction as indicated in the sketch. One installation employs 175,000 cycle current at 17,00 volts.

A third method of flow-brightening, employed on two alkaline lines, involves the use of open-flame gas-radiants. Developed by the Selas Corporation in conjunction with the Inland Steel Company, the procedure employs panels of open-flame radiants burning pre-mixed gas. The panels are mounted opposite each face of the strip and can be moved closer to or farther from the strip surface to vary the intensity of heating. Precise control of heating is gained by two linkages. A radiation pyrometer picks up the strip temperature and controls panel position via a potentiometer and motor drive. Supplementing this, an oil pump driven by a slave roller from the strip operates a diaphragm valve which controls fuel input to the burners (Fig. 13). This method of flow-brightening works extremely well and claims advantages of high operating speeds, small space requirements, low maintenance costs and essential simplicity. The way in which the system is connected into the Inland Steel Company's stannate line is sketched in Fig. 14.

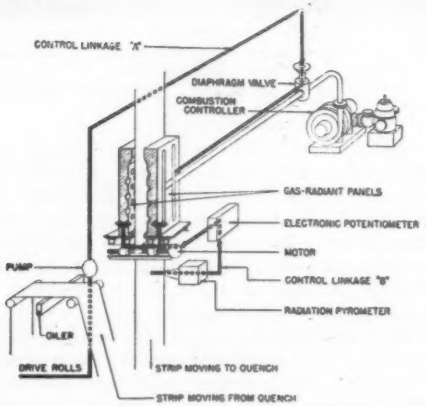

Fig. 13. Diagram illustrating the gas radiant method of flow-brightening.
(*Courtesy "Iron and Steel Engineer."*)

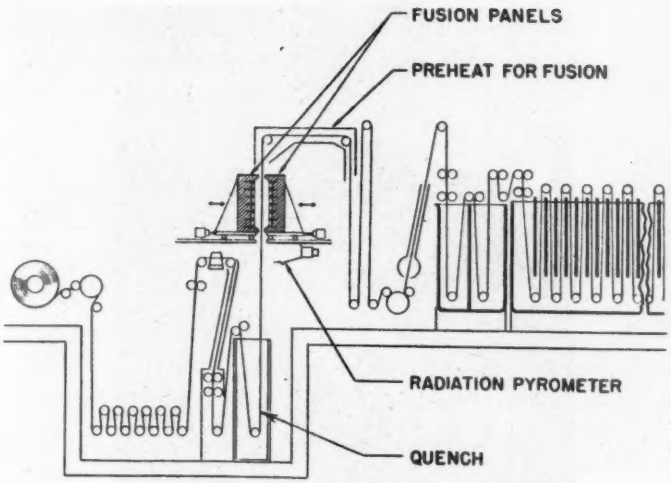

Fig. 14. Open flame gas radiant heating at end of alkaline line.
(*Courtesy "Iron and Steel Engineer."*)

By reason of their long plating pass line, alkaline plants are able to work at speeds of 450-650 ft. per min. with cathode current densities of the order of 40-50 amperes per sq. ft. For example, using equation (2) on p. 110 and dividing by 2 because deposition is from the stannic ion, with an efficiency of 92 per cent., current density of 45 ampères per sq. ft. and a pass line of 350 ft.

$$\text{Tin deposit} = 0.567 \times \frac{45 \times 0.92 \times 350}{2s}$$

$$= \frac{4100}{s}$$

An 8 oz. coating is thus obtained at 512 ft. per min.

Although existing alkaline lines are equipped with long plating pass lines, it may well be that new lines of this type could be designed for shorter plating times following the developments indicated on p. 109. It has been reported, for example, that 38 in. wide strip has been plated with an 8 oz. tin coating at 1,000 ft. per min. in an alkaline stannate bath.

Two views of exit end processing operations are shown in Figs. 15 and 16.

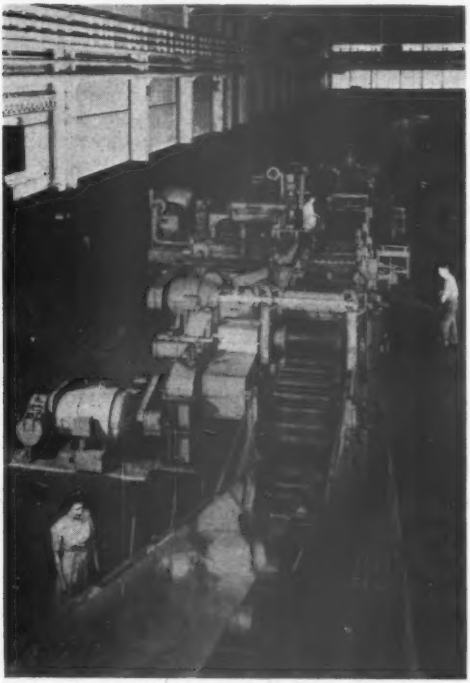

Fig. 15. Exit processing unit on Ferrostan line.
(Courtesy Wean Engineering Co. Inc.)

COMPARISON OF ELECTROLYTES

Much has been written and argued on the merits and demerits of the various electrolytes for high-speed tin plating, and it is safe to say that the subject will be a recurring source of discussion in the tinplate industry for some time to come. A number of important factors have already been mentioned, e.g., current density range, D.C. power requirements, operating temperature, efficiency, and handleability of electrolyte. A point that has not yet been taken up, however, is the quality of the product, which is obviously a primary consideration.

Present experience indicates that there is little to choose between the various electrolytes on this score. In the earlier stages this was not so, and difficulties were experienced with the soldering quality

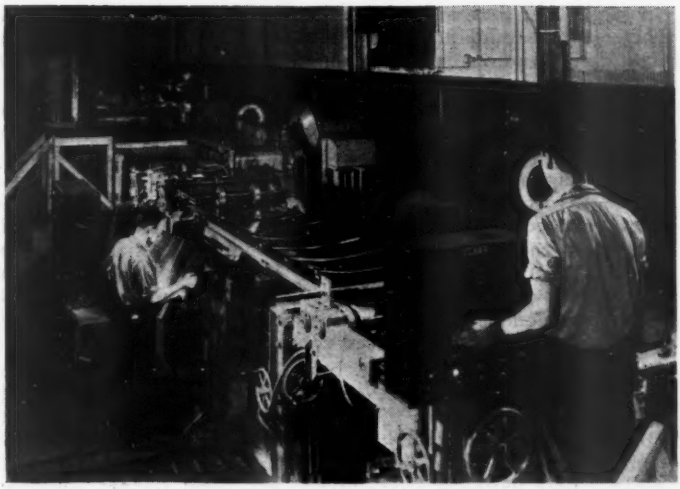

Fig. 16. Exit end of Ferrostan line.
(*Courtesy Wean Engineering Co. Inc.*)

of plate from the acid baths and with the lacquering quality of plate from the alkaline baths. Better understanding of the preparatory processes, and improvements in finishing operations such as flow-brightening and filming have, however, largely ironed out these difficulties.

As far as corrosion resistance or " shelf-life " of electro-tinplate containers is concerned, differences between the products from the various baths seem broadly negligible. An opinion has been expressed that alkaline baths may yield a slightly better average quality plate due to the " self-cleaning " action of the hot alkali on the steel strip. It has been shown, however, that acid baths can, and do, produce coatings of equal test quality, though admittedly alkali baths might, on occasions, show a marginal advantage due to an ability to overcome chance variations in strip surface cleanliness.

Generally speaking, therefore, choice of electrolyte depends on overall production costs, which in turn are influenced by initial cost of plant, engineering and electrical maintenance, labour, D.C., power costs, heating costs, chemical costs, wastage, tin efficiency and amortisation. A further set of factors to be considered are production rate, size of production unit in relation to the market

envisaged, and flexibility in regard to thickness of coating plated. These latter considerations are, of course, closely bound up with plant design and, in the last analysis, electrolyte and type of plant must be considered together.

One would suppose that the ideal electrolyte should plate from the stannous ion and have low ohmic resistance (giving minimum D.C. power costs) ; should have a wide cathode current density plating range (giving short plating pass-line length and flexibility in regard to coating thickness); should have a fair working temperature range (to give good heat balance) ; and should have good anode and cathode efficiency. Furthermore, its requirements in make-up chemicals should preferably be low so as to keep down drag-out loss costs. It should be non-corrosive to usual materials of plant construction, and, finally, it should respond to a reasonably straightforward scheme of process control.

Considering what has gone before, it will be seen that the established electrolytes meet certain of these requirements, and closely approach others. None of them, however, scores a "possible." Since the early days of the process notable improvements have been made, and it would seem very probable that research and technical development will yield further valuable modifications in the next few years. Perhaps one day someone will exhume the old caustic-potash-stannous chloride bath and by the exercise of some electro-chemical magic, confer on it the ability to plate at high current density and good anode efficiency. It is quite true that one of the main reasons why this early bath was rejected was its inability to plate the relative great thicknesses ordinarily required in still-bath article plating. But at least it has the "paper" advantages of non-corrosiveness, wide temperature range, low tin content, and it plates from the stannous ion. The stannous fluoborate electrolyte is another solution which may respond to the pressure of research and enter the electro-tinplate field.

THE FUTURE OF ELECTRO-TINPLATE

Everyone in the industry discusses the future of electro-tinplate and he would be unwise who attempted to be dogmatic. One technique of prophecy is to write down the past and do a straightforward extrapolation. In this particular case, however, such a procedure would not be satisfactory. Much of the history of electro-tinplate development occupied the war and immediate post-war years. These years were, as we know, characterised by seller's market condition, end-use restriction on both tin and tinplate, shortage of supply of tinplate and abnormal trading conditions giving, generally, very quick turnover. These factors were all naturally stimulative to demand for thinly-coated electrolytic plate.

Further, most electrolytic development occurred in the U.S.A. Our friends in the States have a tinplate production of over three times the rest of the world put together, and moreover, their tinplate usage picture is very different from that, of say, this country or the European continent. For example, about one-third of their tinplate goes into non-food packages, which are generally somewhat less critical in their requirements for corrosion resistance in container materials than comestibles.

The present situation in America is that about 40 per cent. of their production is hot-dipped and 60 per cent. is electrolytic. In Europe electrolytic production at present is well under 10 per cent. but in the next year or two the figure will probably rise to over 30 per cent. The pattern of development will undoubtedly be affected by current developments, towards the economic production of electrolytic tinplate of heavier coating weight, e.g., 12 oz. or 16 oz. per basis box.

In summarising it may be said that electro-tinplate will occupy an important and probably major position in the world tinplate industry and will, by its inherent ability to produce coating grades closely-matched to particular packaging requirements, encourage an overall wider use of tinplate. It will place, and indeed already has placed tinplate in a more powerful position to resist the advance of other materials into the container field.

The packaging industry still requires very important quantities of high corrosion-resistance tinplate, the majority of which market is presently held by the hot-dipped product. The penetration of electro-tinplate into this field will largely depend on the development of plants capable of producing 16 oz. or heavier coatings at costs competitive with the hot-dipped product. Much consideration is being given to this aspect at present, and one can only say that these lines of thought are proper and natural ones and that valuable results may be confidently expected.

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REPORT OF THE MEETING OF COUNCIL

25th January, 1951

COUNCIL held its third meeting of the present Institution year on Thursday, 25th January, 1951, at 36, Portman Square, London, W.1. Mr. Walter Puckey, Chairman of Council, presided and 34 Council Members were present, including two Graduate Section Chairmen. It is intended that in future two Graduate Section Chairmen be invited to attend Council Meetings, in rota.

ELECTION OF PAST PRESIDENTS The following Past Presidents were elected to serve on Council for the year 1951-52 :—

The Rt. Hon. Viscount Nuffield, G.B.E.
Dr. Herbert Schofield, C.B.E.
Mr. J. D. Scaife.
The Rt. Hon. Lord Sempill, A.F.C.

ELECTION OF VICE-PRESIDENTS The following Past Chairmen of Council were elected to serve on Council as Vice-Presidents for the year 1951-52 :—

Mr. J. E. Blackshaw, M.B.E.
Mr. E. W. Hancock, M.B.E.
Mr. T. Fraser, C.B.E.
Mr. J. E. Hill.

FINANCE The Statement of Income and Expenditure for the six months ended 31st December, 1950, showed that finances were running very closely to the budget. An analysis of membership revealed that the intake of new members was rather less than the target increase for the year. All Sections were asked to redouble their efforts to attract to the Institution's ranks many more individuals of the highest qualifications.

It was particularly noted that considerable savings would accrue in the current year following negotiations with the Journal advertising and printing contractors by the Chairman of the T. & P. Committee, and Council expressed appreciation of Mr. Stuchbery's services in this respect.

HARROGATE CONFERENCE, 28th JUNE-1st JULY, 1951 Arrangements had been made to receive approximately 750 people at Harrogate, made up of 500 members and 250 guests. It was decided that Section participation in the Conference should be encouraged to a very high degree. It was hoped that the Conference would be a landmark in the progress of the Institution, and it was difficult to think of a better way of encouraging attendance and participation in technical matters than through the Sections.

COUNCIL PROCEEDINGS Council considered a proposal made by the Technical and Publications Committee that some time should be found at Council Meetings for general discussion on topics of interest to the profession as a whole, as distinct from purely domestc business. It was agreed that as an experiment a discussion should be held on the evening before the next Council Meeting. Mr. J. E. Baty, Chairman of the Standards Committee, agreed to open the discussion on " Is Industry's Contribution to the Formulation and Adoption of Universal Standards Good Enough ? "

ELECTION TO HON. MEMBERSHIP Mr. J. D. Scaife, Past-President, was unanimously elected an Honorary Member in recognition of his unfailing services to the Institution since its foundation.

APPOINTMENT OF SECRETARY The Chairman reminded Council that he had been charged with the duty of receiving recommendations with a view to filling the vacant appointment of Secretary of the Institution. After careful consideration, he had come to the conclusion that in view of the energy, initiative and enthusiasm in Institution affairs displayed by Mr. Woodford, as Acting Secretary, he could not do better than propose his appointment as Secretary, a recommendation which received the unanimous support of the Finance and General Purposes Committee. The proposition was carried unanimously.

LORD AUSTIN PRIZE The President announced that the Directors of the Austin Motor Company had informed him that they had decided to donate a further £500 to the Lord Austin Prize Fund. Council passed a unanimous vote of appreciation of this generous donation, and the Education Committee have been asked to reconsider the terms and conditions of the award in view of its greatly increased value.

HIGHER TECHNOLOGICAL EDUCATION Mr. W. E. Park, Chairman of the Education Committee, reported that detailed comments had been submitted to the Minister of Education on the report of the National Advisory Council for Education in Industry and Commerce.

A recommendation had also been submitted to the Anglo-American Council on Productivity, through the Chairman of Council, that consideration be given to the formation of a team to visit the United States to investigate and report on facilities for the education and training of production engineers in that country. The Chairman of Council reported that negotiations were proceeding. There was a possibility that the Institution might be asked to assist in studying all the reports already made, and recommend ways and means of implementing in British industry the common technical threads.

HUTCHINSON MEMORIAL AWARD The Award for 1950 will be made to Mr. H. G. Bottomley, Graduate, for his paper on "Recent Developments of Production Grinding Machines."

EDUCATIONAL ACTIVITIES There were now 38 colleges in the United Kingdom offering courses of study for the Higher National Certificate in production engineering. Many more requests for help and guidance were being received from Sections outside the United Kingdom.

MEMBERSHIP Mr. E. P. Edwards, Chairman of the Membership Committee, reported that some divergence of opinion had arisen in the interpretation of the new examination regulations and membership qualifications. He pointed out that Council had adopted the new regulations as a part of Institution policy and the new rules must be conscientiously applied, even though it might mean rejection of applications which, in the past, would have been acceptable.

JOURNAL In presenting the report of the Technical and Publications Committee, the Chairman, Mr. A. L. Stuchbery, referred to the revised contracts for printing and advertising, and said that it was hoped to devote some of the savings to the improvement and extension of the Journal, details of which were circulated to Council and approved.

He pointed out that the technical press showed interest in many papers presented to the Institution. If advance copies of papers were submitted to Head Office, it would be possible to ensure publication concurrent with delivery, with considerable benefit to the Journal.

COMMON SUBJECT It was recommended by the Technical and Publications Committee and agreed by Council that the Common Subject for the 1951-52 Session should be : "Recent Developments in the Economic Use of Materials."

RESEARCH Mr. M. Seaman, deputising for Sir Lionel Kearns, Chairman of the Research Committee, said that the work of the Committee could be summarised under four main headings : Work Measurement Research, Time Study Training, Machine Utilisation, and Measurement of Efficiency of Processes. Much valuable work was being done.

MATERIALS HANDLING The Sub-Committee had prepared a draft syllabus on the teaching of principles of Materials Handling, which would be submitted to the Education Committee, and had also recommended the establishment of a short course for teachers of the subject, to be followed by a pilot course of post-graduate lectures.

The Sub-Committee were engaged in the preparation of an interim report for publication in the near future.

STANDARDISATION Mr. J. E. Baty, Chairman of the Standards Committee, said that the question of standardisation of nomenclature in the field of Materials Handling would be discussed with the British Standards Institution, as requested by the Research Committee.

Mr. Baty also called for more suggestions for standardisation from members.

LIBRARY Mr. A. Oppenheimer, Graduate, presenting the report on behalf of the Chairman of the Library Committee, Lord Sempill, said that the Library was being used to an increasing extent, and many members would be aware of the fine service being given by the Librarian, Miss P. L. Cooper.

The publication of Abstracts had proved highly successful, and the Committee were very grateful to those members who were giving active assistance on this work.

LOCAL SECTION REPORTS

Adelaide.

The Inaugural Meeting of the Section was held on the 27th July, 1950, in the presence of the Australian President, members of the Australian Sub-Council and approximately 80 members and visitors. Mr. C. A. Gladman, head of the Production Engineering Department of the Sydney Technical College, gave a lecture entitled " Basic Features of Production Engineering."

On 31st August, 1950, a lecture was given by Mr. A. G. Jones, Senior Engineer of the Ordnance Factory, Bendigo, on the " Production of High Speed Marine Gears," and on 28th September, 1950, a lecture was given by Mr. H. H. Palmer, Foundry Superintendent of Perry Engineering Co., on " Planning in the Jobbing Foundry." Mr. W. Gwinnett, the new President of the Adelaide Section, was in the chair. A visit to General Motors Holdens took place on 26th October.

On 16th November, 1950, a lecture was given by Mr. Taylor Gill, Special Representative of Edgar Allen of Sheffield, on " Present Trends in Tool Steels and their Application."

Regular Committee Meetings have also been held during the quarter.

The new Section started with 16 members and another four members have since joined. Numerous applications for membership have been forwarded to the Australian Sub-Council, and another batch of applications is expected early next year.

The Committee feels that a very good start has been made, and, with the enthusiastic co-operation of all members, the Section is looking forward to very interesting activities and substantial expansion.

Birmingham

Lecture meetings continue to be well attended with good discussions. Two joint meetings with kindred bodies have proved successful. The first of these was with the West Midlands Branch of the Institution of Works Managers, when " The Role of the Production Engineer in Industry " was the subject of a joint discussion before a crowded meeting. The second joint meeting, was held with the Industrial Applications Section of the Royal Statistical Society. Professor T. U. Matthew was Guest Chairman at this meeting, and Mr. L. H. C. Tippett spoke on " Production Engineering and Statistical Control."

The Section Research Group on Mechanical Handling continue to make progress with their investigations into inter-process mechanisms and several visits to local works have been made and case studies are being prepared.

The Section has been actively concerned with the organisation of the Birmingham Productivity Exhibition through Mr. T. W. Elkington, its representative on the Exhibition Committee. The work of this Committee was successfully concluded on 29th December, when the Chancellor of the Exchequer, supported by prominent local industrialists, opened this Exhibition. This Section of the Institution was responsible for the stands and demonstrations showing new and improved methods of work handling, production,

and jigs, fixtures and gauging methods. The Exhibition was designed to bring to the attention of all levels of industry the benefits to be gained from improved methods.

Provisional arrangements are in hand for a Mechanical Handling Conference to be held in Birmingham early in 1951.

A special meeting has been arranged for 28th February, in the Birmingham Chamber of Commerce, when Mr. B. E. Stokes, who recently visited the U.S.A. on a Schofield Travel Scholarship, will give his paper, " Some Aspects of Production Control in the U.S.A."

Birmingham Graduate

PROGRAMME.—The lecture on " Modern Methods and Developments in Heat Treatment Practice," by Mr. K. J. B. Wolfe, was very well attended and proved of general interest. The following lecture meetings were successful and good attendances were achieved although evening classes were then in full swing.

WORKS VISITS.—Only a small party attended the visit to Joseph Lucas Ltd. Arrangements are being made for a further visit in the near future as members were very much impressed.

COMMITTEE.—Through Mr. Irwin leaving Birmingham, the Section has lost a very able Secretary. His good work has been appreciated throughout the Section, and the Committee wish him every success in his new appointment. The scheme of delegation of secretarial duties is now working smoothly. Mr. Spear is looking after lecture meetings; Mr. White—Visits; Mr. Hipkiss—Publicity; and Mr. Brown is Chairman of the Social Sub-Committee.

To give junior members a better insight into the running of the Section, to acquaint them with members of the Committee, and to promote a greater feeling of cordiality amongst members, they are now being invited to one Committee meeting each as onlookers.

Concern has been expressed at the lack of Graduate papers, but every effort is now being made to improve matters. A small Sub-Committee has been set up to discuss any doubtful points with intending authors and to help them where possible. The Chairman is preparing a circular asking for papers for next Session and acquainting members once more with details of awards.

The Committee thank Head Office for their co-operation and interest.

Bombay

During the present quarter, two full Section meetings have been held. The October meeting proved a most successful innovation, taking the form of a well thought out questionnaire consisting of

eight carefully selected problems of particular interest to Production Engineers which were placed before the meeting for discussion and solution.

At the November meeting, a paper entitled " Measurement of High Temperatures " was read by Mr. A. E. Hook, A.M.I.Prod.E., the Admiralty Inspector of Foundries, attached to the Indian Naval Dockyard in Bombay. Of particular scientific interest, the subject was well received and formed the basis of a lengthy discussion.

Attendance at meetings continues to be satisfactory and applications for membership are coming in at a gratifying rate from the required type of engineers.

The Working Group formed to report on Materials Handling is steadily progressing its investigations and a report will be prepared and submitted at an early date.

Calcutta

The Section has been very active these last two months. Applications are still coming forward, and monthly Membership Sub-Committee meetings continue to be held.

A circular has been sent to representative industries on the question of Mechanical Handling, but so far only one reply has been received.

The new Section President, Mr. H. Gibson, M.I.Prod.E., gave a very good address in September. This was followed by a talk in October by Mr. Ram Chandran on " Jig and Tool Design." Members were interested, and the talk was ably assisted by lantern slides. In November, Mr. G. D. R. Davison, A.M.I.Prod.E., gave a talk on " Works Systems," and this paper brought forth some interesting comments and a good discussion followed. Also in November, Mr. Lilien gave a talk accompanied by lantern slides entitled " Modern Printing Methods." A talk by Major J. H. Partridge, M.I.Prod.E., Master of the Calcutta Mint, was given on " Mass Production of Coins " in December.

A Works visit was made to Burn & Co., Ltd., Howrah, in September, and members were able to see possibly the finest mechanised foundry installed in India. In November there was a visit to the Bata Shoe Factory at Batanagar, and members were able to see shoes of all types being manufactured on a production basis.

It is hoped that meetings will be still better attended in the future, as attendance is still poor.

Eastern Counties

LOCAL ACTIVITIES.—Lectures were held in September, October, November and December. All these meetings were well attended

and proved interesting. Again the December meeting was held in Colchester, jointly with the Colchester Engineering Society. Mr. Dimmock's lecture in November on " Materials Handling " provided added interest in view of the newly-formed Working Group on this subject. The October lecture on " Photoelastic Stress Analysis " was given by a local metallurgist, Mr. Widdas of Ransomes, Sims & Jefferies, Ltd. A Working Group has been formed on " Materials Handling," and it is hoped to report progress in the New Year.

TECHNICAL PAPERS SUBMITTED FOR JOURNAL—Two papers have been submitted to Head Office. One from Mr. Diamond on " Standardisation in Engineering " and the other from Mr. Widdas on " Photoelastic Stress Analysis." The December lecturer, Mr. F. B. Priest, has promised to submit a paper on " Modern Adhesives."

MEMBERSHIP GROWTH.—A steady flow of applications continues to be received. Negotiations have started with a view to forming a Sub-Section in Norwich. This scheme should be beneficial to our members in that area and provide a basis for expansion of membership.

EDUCATION.—The Ipswich School of Technology propose starting a Higher National Course in Production Engineering in 1951.

Invitations to our lectures are regularly posted to the Principal for distribution to staff and students.

Coventry Graduate

The 1950-51 session opened with a " Report on the Working of Study Groups " by four members of the Committee. With the Section President in the Chair and a good audience in attendance, the Report proved to be most interesting.

In October, an excellent lecture was given by Mr. R. L. Tandy on the " Manufacture of Ball and Roller Bearings." This, once again, was very well attended, much to the satisfaction of the Committee. The November meeting consisted of a lecture on " Motion Study," given by Mr. R. Avery. With yet another good attendance, this lecture provided some interesting discussions. Following a most disappointing attendance at the December meeting, it was decided by the Committee that in future, two meetings would be held in November, cancelling December meetings altogether.

In order that a personal contact could be made with fellow Students and Graduates, a number of them have been invited to the Committee meetings to air their views regarding local Section activities.

Edinburgh

The first half of the lecture programme has now been completed and attendance has been somewhat disappointing—the average being twenty-five.

Two members of the Section Committee, Messrs. Wotherspoon and Grant, have joined the Edinburgh Advisory Council for Continuation Schools Engineering Section Committee. They have taken an active part in the work of the Committee, which consists of visiting Continuation Schools and advising on improvements in methods and equipment. Mr. Barrell has been nominated as the Section Committee's representative on the Edinburgh Pre-apprenticeship Committee. This Committee has not met since his nomination and there is no business to report. Mr. King has been nominated to represent the Section on the Midlothian Committee for Continuation Schools, but has not yet taken up duty.

Glasgow

In October a lecture was given by Mr. R. G. Winton, A.M.I.M.E. A.M.I.Prod.E., on " Materials Handling," which dealt mostly with mechanical handling by use of fork-lift trucks. Films were also shown, which were of great interest to attending members. On 16th November, Mr. H. G. Bottomley, Grad.I.Prod.E., gave a lecture on " Latest Developments of Grinding Machines." This lecture was well received. On 14th December, Mr. W. Risk, C.A., F.C.W.A., gave a lecture on " Productivity and Costs." This lecture was most instructive and entertaining.

One Committee Meeting had been held during this quarter, and a special Committee Meeting was called to meet Mr. W. C. Puckey, who gave the Committee some instructive ideas on the lines to be adopted in the Membership Campaign, materials handling, and finance.

Applications for membership continue to be satisfactory.

Halifax

The Halifax Section feels very proud that its President, Mr. I. G. Hopkinson, was invited to take part in the Steel, Iron and Non-Ferrous Valve Productivity Team which left England for the U.S.A. on 7th November last. The Section is especially pleased, as Mr. Hopkinson is the second member of the Committee to be included in such a team, Mr. G. W. Nicholls having recently returned from the States as a member of the Grey Ironfounding Productivity Team.

The October lecture proved to be a very good opening to the season, when Mr. H. H. Norcross presented his lecture on " Costing as an Aid to Management." This lecture had been postponed

from the previous session, and it proved to be very well worth waiting for. A film entitled " Precision with Production " was very well received for the November lecture. In November, the Annual Dinner and Dance was held at the George Hotel, Huddersfield, when the principl guests were the deputy Mayor of Huddersfieod, Alderman D. J. Cartwright, O.B.E., R. McKie, Esq., and the President, Major-General K. C. Appleyard, C.B.E. Once again this proved to be a very successful evening, and the event grows in popularity each year. The David Brown Tractors Engineering Society met with the Section for the December meeting. when Mr. F. T. Dean read his paper on " Mechanical Handling." Judging by the discussion which followed, it would appear that this present-day vital subject was ably dealt with.

The Education Officer, Mr. T. B. Worth, is to visit the Section in February, and arrangements are in hand for a full programme during his stay.

The Committee continues to meet regularly and the last meeting was combined with a Works visit to Frederick Smith & Co., Ltd., Wire Manufacturers.

Lincoln

GENERAL.—Following the Chairman of Council's letter to the President under the heading " The First Quarter," the Section Committee's quarterly agenda has been set up to deal with the points raised in this letter, and the Section Quarterly Report has been submitted covering the items mentioned.

LOCAL ACTIVITIES.—Following the initial very successful meeting on Mechanical Handling, at which 102 members and visitors were present from various areas, further meetings that have taken place have been very fully attended. On 31st October last a meeting was held in Lincoln Technical College, in conjunction with Lincoln Engineering Society, at which 126 members and visitors were present. Talks were given by five members of Productivity Teams who had visited America during the last 12 months. An excellent discussion followed the short talks given by the various members. On 29th November, 60 members visited the Lincoln works of Smith-Clayton Forge, who have recently made considerable alterations to their techniques and handling following their Works Manager's visit to the States. A meeting was also arranged in Gainsborough at the invitation of local members and the Gainsborough Engineering Society, at which Mr. J. R. Bergne-Coupland and Mr. H. M. H. Fox spoke on the need for greater productivity, and the quite simple methods by which improvements could be made in British factories.

RESEARCH—WORKING GROUPS.—The Section have one or two junior members who have volunteered to form Working Groups, but at the moment this has not gone forward as quickly as it might, due to the Committee finding it difficult to get suitable Chairmen who have the time to spend, and also a suitable subject which could be tackled thoroughly.

It is realised that certain subjects have been put forward by Council and by the Chairman of Council, but until the Section gets a clearer picture of what is required, no good purpose would be served in starting a Working Group.

TECHNICAL PAPERS IN THE JOURNAL.—The Journal in its new form has been commented upon favourably by the Section Committee and others.

MEMBERSHIP GROWTH. — The confidential Membership Campaign Bulletin has been recently received, and whereas the Lincoln Section has gone up one place since the end of 1949, it hopes to step up considerably in the next few months.

The Section has, at the present time, since the issue of the Membership Campaign Bulletin, three new members to report, four transfers, five applications for membership from Lincoln, and twelve applications for membership from the Gainsborough area. These applications are in course of review either in the Section or at Head Office.

EDUCATION.—Mr. Worth is due to come to Lincoln for the Annual General Meeting, and arrangements are being made for him to visit various organisations in the area, and the Technical College.

Liverpool

LECTURES AND DISCUSSIONS.—Two papers were given to the Liverpool members: "Lighting for Production," by Mr. W. Robinson, B.Sc., A.M.I.E.E., and "Inspection Standards as an Aid to Production," by Mr. J. Hobbs. Both lectures were well attended and provoked lively discussions. The "Brains Trust" was the first held by the Liverpool Section and was so successful that there have been many requests for another date to be allocated for a further "Brains Trust" meeting.

MEMBERSHIP.—Membership continues to increase steadily, the total now being 174 with 8 new applications before the Membership Committee. It is the aim of the Liverpool Section to attain a membership of at least 200 before their Annual General Meeting.

SUB-COMMITTEES.—A great deal of the work of the Liverpool Committee has been devoted to the establishment of various Sub-Committees to undertake specialised activities of the Institution. Members were asked to volunteer, and an excellent

response was obtained. The following Sub-Committees have now been established :—Technical Education, Standards, Technical Publications, Research, Social Activities, Hazleton Memorial Library.

Liverpool Graduate

The series of lectures up to the end of 1950 has been well attended. A Works visit to Messrs. John Summers has been held, and the party of 30 had an enjoyable and instructive evening.

In conjunction with the Senior Committee it is intended to commence the formation of a number of Sub-Committees early in the new year.

London

Four successful lecture meetings have been held by the Section, all being well attended and having interesting discussions. The lecture programme commenced on 12th October, when Mr. C. R. Whitaker gave his paper, " The Future of Production Engineering," and on 16th November, Dr. D. F. Galloway lectured on " Research in Relation to Production Engineering." Mr. H. W. Townsend read a provocative and thought stimulating paper on 7th December, entitled " The Toolroom—Its Relation to Production." On 30th November, the first of a series of meetings in outlying areas was held in the canteen of Creed & Co., Ltd., Croydon, when a lecture on " Recent Developments in Precision Grinding " was given by Messrs. A. Pearson and R. J. Barton. This meeting was very well attended, both by members and visitors, and encourages the continuance of the plan for holding meetings away from the centre of London. Two similar meetings are scheduled for this session—one at Croydon and another at Brighton.

South Essex.—The Inaugural Meeting of this new Sub-Section on 18th October was very well attended, there being 49 members and 201 non-members present. Mr. D. Bailey, Chairman of the Sub-Section, was in the Chair, and Mr. W. C. Puckey gave an address on " Public Service Through Production."

A meeting was held in Chelmsford on 29th November, when Mr. T. B. Worth gave a lecture on " The Education of the Production Engineer." In a total attendance of 100 there were 20 members.

Although this new Sub-Section has aroused considerable interest in the area and the meetings are well supported by visitors, the Committee is rather concerned at the lack of support from members. Circulars and questionnaires have been sent to members in this area, as it is felt that greater support from members is essential, particularly in the early stages of the Sub-Section's formation.

ROCHESTER AND DISTRICT.—This Sub-Section held lecture meetings on 9th November and 14th December, on which respective dates lectures were given on " Diamonds in Industry " by Mr. M. A. M. Livingstone, and " The Assessment of Production Engineering Training " by Mr. T. B. Worth. About 60 attended each meeting.

READING.—A meeting was held on 7th November, when Mr. Lewis C. Ord talked on " Requirements for Efficient Production." Another meeting was held on 5th December, when a paper " The Temporary Protection of Engineering Components and Assemblies Against Corrosion " was given by Mr. R. J. Brown. Again a complaint is made that members do not give sufficient support to meetings.

CROYDON.—The Croydon Study Groups are meeting and are studying the manufacture of a fractional horse-power motor. A complete scheme for manufacture—such as would be laid out on paper in an actual manufacturing organisation—is being prepared.

MEMBERSHIP.—The Membership Campaign continues to show satisfactory results.

Luton

The Section has had a successful beginning to the new Session. Three lectures have been delivered and attendance has been very good in all cases. A special joint meeting with the I.C.W.A. has also taken place and was well received.

A working group on Materials Handling has been formed and joint discussions with the Graduate Section working group on Measurement of Productivity is envisaged in the near future.

Melbourne

Regular monthly lecture meetings have been held dealing with a wide variety of interesting subjects. Great interest was evinced at the May meeting, resulting in the largest attendance to date at a Melbourne Section gathering. Before 143 members and visitors, Mr. John Lewis, Broach Engineer of Sutton Tool & Gauge Manufacturing Co., Ltd., delivered a paper entitled " Use and Advantages of Broaches in Australian Industry."

A most interesting function was arranged by the Section Committee in November at Menzies Hotel, Melbourne, where the Committee met and entertained Sir Lionel and Lady Kearns at a dinner. Sir Lionel afterwards discussed, in an informal manner, the objects and activities of the Production Engineering Research Association of Great Britain.

North Eastern

The programme of lectures arranged is now in full swing and playing an important part in the Membership Campaign. Attendances at lectures are very encouraging to the Committee.

The session opened with an address by Mr. R. W. Mann, the Section President, on " The Production Engineer and Management " which was keenly followed by a discussion which provoked great interest. The October lecture by Mr. J. H. Smith on " Costing for the Smaller Engineering Firms " was also well attended and was followed by a very good discussion. The November lecture on " Foremanship " was given by Mr. A. P. Young, O.B.E., and proved interesting from a new angle which gave members food for thought.

A Working Group on Materials Handling has now been formed.

A gratifying increase is noted in the Applications for Membership.

Arrangements have now been made for members to have tea before the meeting so that they can get to know one another, and a Reception Officer has been appointed to look after and introduce members to each other. The Committee has also arranged to hold its meetings on a separate night, so that it can also mix with members. A Dinner and Social Evening is being arranged in early March to which members are being invited to bring their wives and friends.

North Eastern Graduate

Papers given at General Meetings this session have been of a high standard. The Chairman's address entitled " Pressure Die Casting " was illustrated by a film and aroused considerable interest. The address by the Chairman of the Senior Section on Production Engineering was received with enthusiasm. In November, a lecture on " Stud Welding " was given, and a very lengthy discussion ensued. Works visits to Consett Iron Co.'s works and to the Jarrow Tube Works were of considerable interest, and members were well received.

Generally a lack of enthusiasm is observed in members, meetings and works visits are poorly attended and reminders do not seem to improve matters. The Section Committee is at present concerning itself with ways and means of improving attendances.

Nottingham

The session opened with a talk by Mr. Lewis C. Ord, on " What is wrong with British Industry ? " As usual, this talk created a good discussion.

The second meeting was held jointly with the Institute of Cost and Works Accountants, when members discussed " Measurement of Productivity." At the December meeting, Dr. R. H. Barfield gave a most interesting lecture on " High Frequency Heating." The paper, which was illustrated by slides, was followed by a demonstration of hardening, etc., by this method. In January, this Section joined the Institute of Cost and Works Accountants to debate on " Monetary Incentives do not Increase Production, but Merely Become a Wage Increase."

The attendance at meetings this session have, so far, been slightly better than last year, particularly visitors, some of whom have already become members, and more applications are pending.

Manchester

LOCAL ACTIVITIES.—The session commenced in September with a paper on " Atomic Energy," by Mr. C. Hinton, Deputy Director of Atomic Energy Production, Risley. It was of great interest to all present. In October, Mr. W. Robinson gave a most provocative paper entitled " Joint Consultation in Industry." The discussion which followed was interesting and instructive. In November, Mr. J. Milwain gave a repetition of his paper, previously given to other Sections, entitled " Production and Inspection of Gears." This meeting was very well attended.

RESEARCH.—As already reported in the Journal, the Work Measurement Research Survey, held in Manchester, was an unqualified success. There was an excellent attendance and the participants were keenly interested. The Manchester Committee is most grateful to one of its Vice-Presidents, Mr. H. G. Gregory, and to the Fairey Aviation Co., for the facilities which were provided on this occasion.

THE JOURNAL.—The Manchester Section are pleased to notice that there are fewer advertisements arranged in the Journal before the subject matter. They are also pleased to notice that increasing space is being found for Institution activities and news of members.

MEMBERSHIP GROWTH.—Considering the size of the Manchester Section, the growth of membership may be considered quite satisfactory. In addition to the efforts made to expand the Institution in the Manchester area, work is now going ahead, following sanction from Council, to set up a Stoke-on-Trent Sub-Section attached to the Manchester Section.

EDUCATION.—The Manchester Section Committee has given support to the principle of expanding the Salford Royal Technical College, and the Section President, in addition to asking support from the President of Council, has urged this in letters to local and county authorities.

Mr. F. W. Cranmer, Vice-President of the Manchester Section, is representing the Institution of Production Engineers on an Advisory Committee to the Union of Lancashire and Cheshire Institutes. He is also on an Advisory Committee at the Salford Royal Technical College, representing the Production Engineers on the Mechanical Engineers' Syllabus.

The Manchester Section Committee has interviewed and reported on a candidate for the Schofield Travel Scholarship.

New Zealand

In May, a meeting was held at the premises of Associated Engineering (N.Z.) Ltd., Panmure, Auckland. Members and their friends were conducted around the Works and the various processes and methods used in the manufacture of pistons and rings were demonstrated and explained. An interesting and instructive evening was spent by all those attending.

The Annual General Meeting was held in August at the President's home. After a review of the past year's activities by the President, the election of Officers for the coming year took place. The Officers were elected as follows :—President—Mr. E. Paton, Vice-President—Mr. F. Fowler, Honorary Secretary—Mr. H. R. Holmes, Honorary Treasurer—Mr. A. J. Lee, M.B.E., Committee—Messrs. F. Cain, H. W. Hollies, J. A. Holmes, H. Pickering. General discussion followed on activities for the coming year, and tentative arrangements were made for visits to be made to different Works whose activities would be of interest to members and also for the loan of films dealing with different engineering subjects. The meeting concluded with the showing of a film " Manufacture of Grinding Wheels " dealing with the processes and methods employed by the Universal Grinding Wheel Co., Stafford.

In September, a visit was made to Tasman Empire Airways base at Mechanics Bay, Auckland. This proved to be a very interesting and instructive visit.

A meeting was held in September, when the Balance Sheet for the year was presented. This showed a satisfactory financial position, and was adopted by the meeting. Members were asked to approach several persons who had the necessary qualifications and endeavour to interest them in applying for membership. In October, a meeting was held, when a film on heat treatment was shown. The film was well produced and aroused quite a lot of interest. After the showing, an instructive discussion followed. A lecture on " Modern Methods of Metal Thread Screw Production " was given in November by Mr. Donald of Amalgamated Products Ltd. The meeting was well attended by members and representatives of local engineering warehouses and engineering

firms who were invited to be present. Amalgamated Products have developed new methods of roll threading and slotting metal thread screws which have created no little interest in America, England and Australia, and Mr. Donald described these methods and gave a history of their development. He also showed samples of the machine parts which were passed around to illustrate the lecture, and had a film showing the new machines working. This meeting was easily the best this year and everyone present thoroughly enjoyed the lecture.

Stoke-on-Trent

A Committee has now been elected. Mr. H. Porter, M.I.Prod.E., has been elected Chairman and Mr. R. Rowley, A.M.I.Prod.E., elected Honorary Secretary.

It is planned to hold the Inaugural Meeting in February, 1951.

Sheffield

In October, the season's meetings were given a splendid send-off by the attendance of 140 members and friends to hear the President, Major-General K. C. Appleyard, C.B.E., speak on " Leadership." This was an inspiring address and full tributes were paid by the Master Cutler, Mr. G. Wilton Lee, and other leading industrialists who were present. Opportunity was later afforded to the President to meet the Section Committee and their guests at an informal dinner party—a very pleasant occasion.

In November, three members of the Anglo-American Productivity Team on Materials Handling, Messrs. A. Roebuck (Team leader), J. R. Sharpe and N. A. Jenkinson, gave a brief survey of the Team's report and then answered questions. This led to a very lively discussion which must have proved useful to the large number of members present. Another successful meeting was held in December, when Mr. A. Scrivener addressed a large gathering on " Developments in Centreless Grinding." His enthusiasm and his competent delivery had an excellent reception and there was a long and interesting discussion.

An additional informal meeting was introduced at the end of October, when the film " Hard Metal " was shown. The success of this venture has encouraged the Committee to try this approach again and a film is to be shown in February, whilst a further informal meeting is arranged for January when members are asked to bring forward some of their own problems for discussion.

South Africa

In September, Dr. J. H. Scholtz, Superintendent of the Coke Ovens and By-Product Plant at ISCOR (South African Iron and Steel Industrial Corporation Limited), delivered a paper entitled "By-Product Coking at ISCOR, Pretoria". The paper was amplified by a film of the Pretoria Works. In October, a paper entitled "Fan Engineering as Applied to Industrial Problems" was delivered to a meeting of the Institution by Mr. F. T. Carter, of Airflo (Pty.) Ltd., at which thirty members and guests were present.

The meeting in November took the form of a "Discussion Evening," at which there were some thirty members and guests. The following subjects were discussed: (i) The Use of Dry Ice for Shrinking—introduced by N. D. Mackay, Esq. (ii) Tolerances and Limits for Press Fits—introduced by A. L. Purdham, Esq. (iii) What Causes Chatter To Occur Suddenly During Boring and How It Can Be Eliminated—introduced by R. H. Arbuckle, Esq.

Dr. J. H. Scholtz of ISCOR conducted an interesting visit of the Institution to the ISCOR Pretoria Works on the 16th November. The visit was well attended.

During the last quarter, six members were recommended for acceptance and two for transfer to higher grades.

Southern

The 1950/51 lecture programme is proceeding satisfactorily. Lectures have been given by Dr. E. J. B. Willey, D.Sc., Ph.D., F.R.I.C., on "Electronics in Industry;" by Mr. B. Holloway, M.I.Prod.E., of the Vauxhall Tool Design Division, on "Efficient Tooling for Production;" and Mr. T. B. Worth has given his lecture on "The Production Engineer—His Education and Training." Mr. Worth also spent several days in the Southampton district visiting Saunders-Roe, Isle of Wight, Airspeed of Portsmouth, Folland Aircraft Limited of Hamble, and finally, Weir Precision of Southampton. He also visited Captain Teare-Harry of the Southampton Technical College. Mr. Worth's visits together with his discussions with the respective firms' Education Officers has stimulated great interest in the Southampton locality, from which it is hoped in future to organise a Higher National Course in Production Engineering at the University College, Southampton.

South Wales and Monmouthshire

In September, Mr. F. T. Dean, M.I.Prod.E., M.I.Mech.E., presented his paper entitled "Materials Handling." This was

accompanied by lantern slides and was followed by a lively discussion. The advertised programme for October had to be changed at the last moment owing to illness of Mr. W. A. Melhuish and his lecture on "Organisation for Production" was postponed to some future date. The Section was fortunate, however, in securing a sound colour film made by Firth Brown Ltd., of Sheffield, entitled "Steelmaking." This proved very interesting indeed and Mr. E. S. Gregory, M.I.Prod.E. (Firth Brown's representative), very ably answered many questions on the subject of the film. In November, a paper entitled "Planning for Batch Production" was given by Mr. W. E. Mosse, Grad.I.Prod.E. This controversial subject was received very well and was followed by much discussion.

On 27th September, the Section held a Dinner in the Park Hotel, Cardiff, at which the guest of honour was the Rt. Hon. G. R. Strauss, and other guests included the Lord Mayor of Cardiff, Major General Appleyard, C.B.E., Mr. Walter C. Puckey, and many notable industrialists. The function was well attended and many expressions of appreciation were received.

A Works Visit was organised in October, and a party of 30 had a conducted tour of the main works of Fisher & Ludlow Ltd., at Castle Bromwich, where the party was received with great cordiality. Tea was provided by Messrs. Fisher & Ludlow after which a visit was paid to their "Pallet" factory at Bordesley. The visit was a great success and everyone was extremely impressed with the up-to-date methods used and the extent to which modern Mechanical Handling can be employed particularly in the question of storage.

It is with extreme regret that the Section reports the loss of Mr. A. V. Bailey, M.I.Prod.E. He left the Section in October and has gone to Crewe to take up an appointment with Kelvinator Ltd. Mr. Bailey is a past President of the Section and has always been a very active Committee member. His untiring efforts on behalf of the Section since its inauguration will long be remembered.

Sydney

ANNUAL GENERAL MEETING.—At this meeting, held in October, Mr. E. G. Bishop was unanimously re-elected President and Mr. C. E. Jones, Vice-President. Also, Messrs. C. S. Curtis, J. E. Strick, E. C. Parkinson and S. E. Barratt were re-elected to the Committee.

Following the reading of the Honorary Secretary's Report, Mr. S. E. Barratt paid tribute to the meritorious service rendered by Mr. J. Steer in his capacity as Honorary Secretary over the last 14 years. Following the Annual General Meeting, Mr. J. Finlay,

M.B.E., Hon. M.I.Prod.E., presented a paper entitled "Forty Years in Production Engineering."

P.E.R.A.—The Sydney Section arranged for Sir Lionel Kearns, C.B.E., M.I.Prod.E., Chairman of the Council and Executive Committee of The Production Engineering Research Association of Great Britain, to give a short address on the activities of P.E.R.A., to the executives of the leading engineering establishments in New South Wales at Science House, Sydney, on Wednesday, 13th September, 1950.

Working Groups.—At the last two Committee meetings much discussion has taken place on the subject of Working Groups and how they can function in this Section. It is hoped that soon after the resumption of membership monthly meetings commencing in March, a working group will be operating.

Work of Membership Sub-Committee.—Since the receipt of the latest publication "Qualifications for Membership" and other correspondence dealing with this subject, the Membership Sub-Committee has done a great deal of work in closely studying this information, and at the last Committee meeting, they furnished an excellent summarisation of these latest qualifications.

In October, Mr. S. E. Barratt, M.I.Prod.E., returned from an overseas visit and amongst his many comments he expressed his appreciation of the assistance he obtained from Headquarters during his stay in the United Kingdom.

Western

The Western Section adopted the same policy for the 1950/51 session as proved successful in previous years by continuing to arrange lectures in the important towns within the Section. So far this session, seven lectures have been held, four of which have been in Bristol, and three in the provinces, whilst two have been joint meetings.

In December, a joint meeting was held with the Gloucestershire Engineering Society and the Plastics Institute at Stroud. Also, a joint meeting was held in Bristol with the Institute of Cost and Works Accountants in December. There is still considerable enthusiasm in the Section, and all the lectures outside Bristol are quite well attended.

The Section held its Annual Dinner and Dance on 25th October, when it was honoured by the presence of the Lord Mayor, the Sheriff of Bristol and his Lady, Major-General K. C. Appleyard, C.B.E., and Mr. W. F. S. Woodford. This has now become a civic function, and a red letter date for the Western Section.

Research.—The Section took part in a Work Measurement Survey, when some 65 representatives of industry in the district

attended a Conference at the Bristol College of Technology. This Survey was very well received.

MEMBERSHIP.—The Section continues to grow, not rapidly, but certainly very steadily, and the Committee is quite confident of the future, so much so, that it is intended to seek authority from Council to inaugurate a Graduate Section in the 1951/52 session.

EDUCATION.—Due to the efforts of the Education Officer and members of the Western Section Committee, a Production Engineering Course has been started at the Bristol College of Technology, and the first course will shortly be completed. Unfortunately, accommodation and facilities are not yet sufficiently adequate for the course to be approved by the Ministry of Education as a Higher National Certificate Course. It will, therefore, be necessary for the students to take Part II of the A.M.I.Prod.E. Examination.

STANDARDISATION.—The Section Committee is glad to report that one of the Western Section members who is on the Standards Committee was selected to represent the Institution at the International Conference held in Paris this year. The Section also has a member on the Sub-Committee dealing with Standardisation of Chucks and Grinding Wheels.

From this brief report, it can be seen that the Western Section still continues to flourish, and the future programme should invite still further potential members to the meetings.

Wolverhampton

The Lecture Session opened with a good start in October, when Dr. Galloway gave his paper on P.E.R.A. This was followed in November by a lecture on "Working Pace and Incentives" by Mr. Lewis C. Ord. This was very well received by an attendance of 150. The December lecture by Mr. Lehmann on "Convection Stoving" was very interesting, but unfortunately weather conditions affected the attendance, only thirty being present. Monthly Committee Meetings are being well attended, and it is pleasing to record that Mr. S. Wright has agreed to serve as a member of the Committee.

The membership continues to increase steadily and it is hoped to pass the 500 mark by the end of the year.

Wolverhampton Graduate

In October, the Section had a film show on the chemical composition and manufacturing methods of "Plastics," presented by Mr. L. A. White. After the film, a lively discussion took place. Mr. White illustrated his answers with many samples of plastic

work. The November lecture entitled " Geologist's Search for Materials of Engineering Production " was given by Mr. A. J. Aiers. An introduction to a vast field of study, seldom touched by the average Production Engineering student, was most lucidly presented and amply illustrated by slides. The lecturer is a recognised authority in the geological sphere.

A Works Visit to Turner Manufacturing Co., Ltd., Wolverhampton, was arranged in October. A party of 30 were shown the various production departments of this company. A further Works visit to Stewart & Lloyds, Alfred Hickman Branch at Bilston, was held in November. A party of 40 witnessed the blast and open hearth furnace charging and tapping, ingot-casting and section rolling at this old-established Company.

The Autumn Dance was held in November at the Star and Garter Hotel. Mr. Tyler welcomed the Chairman, several members of the Senior Section, and 180 Graduates and friends to this, the Section's first Autumn venture. A most enjoyable evening was held by all, and an endeavour will be made to make this dance an annual event.

Yorkshire

The first half of the Session has now passed and the Section has had three good lectures :—" Colour Schemes in Industry " by S. A. Wood, " Activities of P.E.R.A." by Dr. D. F. Galloway, and " Productivity and Costs " by W. S. Risk.

A further three lectures are arranged for the first half of 1951.

Yorkshire Graduate

During the past months this Section has been holding meetings and visits as on the Programme. The lectures have been very interesting, and though the attendance has not been fully satisfactory, there are signs of improvement lately.

The visit to a Transmitting Station was an interesting change from the factories, and the visit to Fairbairn Lawson gave members the opportunity to see the works of a Textile Machinery Manufacturer on a large scale. As some of the departments were working at the time, a wide variety of machine tools were observed in action, also one of the finished textile machines on test.

It is very noticeable that any mention of the Sections individually in the Journal is immediately appreciated by the Graduates in this area, bringing a revival of interest.

ELECTION OF MEMBERS

The following were elected to membership by Council :

As Hon. Member :
Mr. J. D. Scaife.

Adelaide Section.

Transfer :—
From Intermediate Associate Member to Associate Member :
H. J. Baker.

Birmingham Section.

As Members :
W. D. Bullows, K. J. B. Wolfe.
As Associate Members :
F. Beach, A. Crockett, M. Z. H. Elaghoury, E. S. Martin, R. A. Percival.
As Graduates :
G. L. Allen, F. Devine, H. J. Green, J. G. Harlow, H. C. B. Mackenzie, M. I. Mohamed, B. A. Peyton, I. K. Pummell, C. P. Round, R. P. Sampson.
As Students :
R. W. McEvoy, D. G. Vaughan, R. E. Wilson.
Transfers :—
From Associate Member to Member :
C. Spires.
From Graduate to Associate Member :
D. J. H. Bridge, W. R. Childs, N. H. Dixon.
From Student to Graduate :
R. B. Beard, D. G. Coleman, J. A. Harris, A. M. Pritchard.

Bombay Section.

As Members :
G. L. Brough, P. S. Daver.
As Associate Members :
J. B. Hudson, B. V. Mahabale.
Transfers :—
From Intermediate Associate Member to Associate Member :
P. N. Khanna, K. Vishanath-Rao.

Calcutta Section.

As Associate Members :
N. C. Mukherjee, B. D. Sahi, N. N. Sen-Gupta.
As Associate :
A. S. Nagi.
As Students :
J. Chakravarty, E. O. Ollenbach.
Transfer :—
From Associate Member to Member :
J. C. Warren-Boulton.

Cornwall Section.

Transfer :—
From Graduate to Associate Member :
F. G. Hawke.

Coventry Section.

As Member :
D. R. Eaves.

As Associate Members :
F. Hancock, W. H. Sawbridge.

As Graduates :
T. E. G. Fulker, J. L. Perkins.

Derby Sub-Section.

As Student :
D. A. Roberts, F. E. Taylor, A. Whittaker.

Transfers :—

From Intermediate Associate Member to Associate Member :
D. H. Ludlam.

From Student to Graduate :
P. B. Clay.

Eastern Counties Section.

As Graduates :
R. A. Hallam, J. R. Talbot.

As Student :
E. J. Hunter.

Transfer :—

From Associate Member to Member :
A. H. Leggett.

Glasgow Section.

As Graduates :
J. A'Hara, J. S. Campbell, J. Hall.

As Student :
A. Michie.

Transfers :—

From Graduate to Associate Member :
H. J. B. Fisher, R. S. Russell.

From Student to Graduate :
W. J. Bell.

Halifax Section.

As Member :
K. D. Walker.

As Graduate :
P. J. Rothery.

Transfers :—

From Intermediate Associate Member to Associate Member :
A. Godfrey.

From Student to Graduate :
R. Sutcliffe.

Leicester Section.

As Member :
Major-General W. F. Hasted.

Transfer :—

From Intermediate Associate Member to Associate Member :
W. Bray.

LINCOLN SECTION.

AS STUDENT :
J. Short.

Transfers :—

FROM INTERMEDIATE ASSOCIATE MEMBER TO ASSOCIATE MEMBER :
E. G. Mitchell.

FROM GRADUATE TO ASSOCIATE MEMBER :
A. S. F. Davis.

FROM STUDENT TO GRADUATE :
R. N. Smith.

LONDON SECTION.

AS MEMBERS :
P. R. T. Charlesworth, J. Shackleton, E. Wynn.

AS ASSOCIATE MEMBERS :
W. F. Adams, J. Bain, H. E. Dales, C. S. Davidson, G. C. Fairbanks, N. A. Fawkes, D. P. D. Ferguson, G. Gould, G. H. Haines, W. R. Hill, L. C. Hubbard, H. V. Lustig, A. J. Plowman, S. G. J. Smith, C. E. W. Stone.

AS ASSOCIATE :
G. Hendry.

AS GRADUATES :
C. T. Butler, I. R. Cantle, J. D. Kibble, D. J. Little, D. J. Robinson, D. Royston, R. Spilman, P. Trosset.

AS STUDENTS :
J. D. A. Cleaver, J. E. Denney, E. J. E. Elworthy, M. Franks, J. D. Parson, W. R. Wood.

AFFILIATED FIRM :
Ingersoll-Rand Co., Ltd.

AFFILIATED REPRESENTATIVES :
C. L. Parsons.
D. Y. Marshall.

AFFILIATED FIRM :
Wild-Barfield Electric Furnaces Ltd.

CHANGE OF AFFILIATED REPRESENTATIVE:
O. V. Metcalfe.

Transfers :—

FROM ASSOCIATE MEMBER TO MEMBER :
F. A. Culling.

FROM ASSOCIATE TO MEMBER :
A. W. Hallpike.

FROM INTERMEDIATE ASSOCIATE MEMBER TO ASSOCIATE MEMBER :
P. A. Allaway, W. J. Barber, H. G. Kippax, H. J. Lloyd, R. C. Webster, W. Wilkinson.

FROM GRADUATE TO ASSOCIATE MEMBER :
W. A. Cook, E. W. Harris, C. S. Kent, A. E. Kirton, G. S. Mutch, H. H. L. Ward, W. H. C. Webster.

FROM STUDENT TO GRADUATE :
W. Ayres. E. H. Felberg, A. L. Foster, T. L. Issacs, P. L. McIlwraith, E. R. Murray, C. C. Sandford, H. S. Woodgate.

ROCHESTER.

AS MEMBER :
J. R. Kelly.

SOUTH ESSEX.

Transfer :—

FROM ASSOCIATE MEMBER TO MEMBER :
R. R. Kenderdine.

LIVERPOOL SECTION.

AS ASSOCIATE :
F. W. Harrington.

LUTON SECTION.

AS ASSOCIATE MEMBERS :
B. H. Bentley, W. V. Marshall, A. J. Southwell.

AS GRADUATES :
W. J. Ingram, P. J. A. Janes.

Transfer :—

FROM STUDENT TO GRADUATE :
S. Pearson.

MANCHESTER SECTION.

AS ASSOCIATE MEMBERS :
H. S. Ferguson, T. P. Hand, F. Hinton, C. C. Read.

AS GRADUATES :
R. W. Allison, G. A. D. Coghlan, F. Hancock, J. Hanson, M. J. Sinha.

AFFILIATED FIRM :
F. E. Rowland & Co., Ltd.

CHANGE OF AFFILIATE REPRESENTATIVE
H. J. Woodward.

Transfers :—

FROM INTERMEDIATE ASSOCIATE MEMBER TO ASSOCIATE MEMBER :
A. E. Andrew, F. Barlow, E. Hoyle, H. Mills.

FROM GRADUATE TO ASSOCIATE MEMBER :
K. S. Ormson.

MELBOURNE SECTION.

AS MEMBER :
H. J. Hammond.

Transfer :—

FROM STUDENT TO GRADUATE :
J. Airs.

NORTH EASTERN SECTION.

AS ASSOCIATE :
G. Marriott.

AFFILIATED FIRM :
C. Lane & Son.

AFFILIATED REPRESENTATIVES :
C. Lane.
J. Lane.

Transfer :—

FROM ASSOCIATE MEMBER TO MEMBER :
F. Robinson.

NOTTINGHAM SECTION.

AS MEMBER :
Lt.-Col. J. H. Snelson.

Transfers :—

FROM ASSOCIATE MEMBER TO MEMBER :
C. N. T. Manfull.

FROM STUDENT TO GRADUATE :
A. L. Terry.

PRESTON SECTION.

AS MEMBER :
E. Clegg.

As Graduates :
E. Horner, H. Lockton.

As Students :
G. K. Catlow, E. K. Langham.

Transfer :—

From Associate Member to Member :
W. L. Jones.

Reading Sub-Section.

As Associate :
J. R. Immer.

As Students :
M. E. Barton, K. H. Davies, L. J. Lambourne, L. J. Upstone.

Transfers :—

From Associate Member to Member :
J. W. G. Pringle.

From Graduate to Associate Member :
S. D. Taylor.

Sheffield Section.

As Associate Members :
G. Belcher, L. J. Daughtrey.

As Graduates :
J. J. A. Hall, P. T. O'Leary, R. E. Stally.

As Students :
D. F. Tomlins.

Transfer :—

From Graduate to Associate Member :
W. Elwiss.

Southern Section.

As Members :
T. Gilbertson, I. A. Marriott.

As Associate Members :
A. J. A. Armstrong, B. Gavin, H. Lilley.

South Africa Section.

As Associate Members :
D. E. Hamm, R. J. May, C. A. van Coller, P. G. van Zyl.

Transfer :—

From Associate Member to Member :
Major P. V. Sadler.

From Intermediate Associate Member to Associate Member :
J. Ofchinsky.

South Wales and Monmouthshire Section.

As Member :
G. R. Faulks.

As Associate Members :
B. Beaumont, W. Williams.

Sydney Section.

As Member :
J. A. Winters.

As Associate Members :
O. G. Edwards, W. J. Gilmore, R. Harris.

Transfers :—

FROM ASSOCIATE MEMBER TO MEMBER :
J. O. Ogden.

FROM INTERMEDIATE ASSOCIATE MEMBER TO ASSOCIATE MEMBER :
A. A. Wilson Bruce.

WESTERN SECTION.

AS ASSOCIATE MEMBERS :
E. Baker, R. J. Dawes, R. C. Judge, G. Stowe.

AS GRADUATE :
C. H. Separing.

Transfers :—

FROM ASSOCIATE MEMBER TO MEMBER :
H. Teasdale.

FROM INTERMEDIATE ASSOCIATE MEMBER TO ASSOCIATE MEMBER :
F. A. Carey, D. O. C. Hall, J. Waller.

FROM ASSOCIATE TO ASSOCIATE MEMBER :
V. G. Parry.

FROM STUDENT TO ASSOCIATE MEMBER :
C. J. Woodrow.

WEST WALES SUB-SECTION.

AS ASSOCIATE MEMBER :
A. H. J. Saunders.

WOLVERHAMPTON SECTION.

AS ASSOCIATE MEMBER :
S. G. Paddick.

AS GRADUATES :
J. C. M. Chambers, L. W. Carlisle.

Transfers :—

FROM GRADUATE TO ASSOCIATE MEMBER :
M. A. G. Andrews.

FROM STUDENT TO GRADUATE :
A. R. Wilkes.

YORKSHIRE SECTION.

AS MEMBERS :
B. E. Cash, H. Ellis, K. A. Jones, J. N. Mackie.

AS ASSOCIATE MEMBERS :
R. Jarvis, S. Johnson, H. McKechnie, T. G. Robson, S. T. Smith, J. Wilson.

AS GRADUATES :
H. Bottomley, D. Whitney.

AS STUDENTS :
G. H. S. Alderton, L. P. Clark, C. B. Dale, J. G. McDonald, R. Scott, K. G. Watson.

NO SECTION.

AS ASSOCIATE MEMBERS :
G. F. Baggett, G. Davis.

Transfer :—

FROM ASSOCIATE MEMBER TO MEMBER ;
B. L. A. Dorizon.

HONOURS A vote of congratulation to the following members, who had received honours, was carried unanimously : *C.B.E.*, Mr. P. H. Muirhead ; *O.B.E.*, Mr. A. J. Channock, Mr. E. Sanders.

OBITUARY The Chairman reported, with deep regret, the deaths of the following members : Mr. H. H. Adamson, A.M.I.Prod.E. ; Mr. F. R. Barratt, M.I.Prod.E. ; Mr. H. J. Gibbons, M.I.Prod.E. ; Sir Harry Harley, C.B.E. ; Mr. D. B. Nivison, M.I.Prod.E. ; Mr. A. R. Pilkington, Grad.I.Prod.E. ; Mr. R. Zieschang, M.I.Prod.E. The Council stood in silence as a tribute of respect.

DATE AND PLACE OF NEXT MEETING Thursday, 26th April 1951, at 11 a.m., at 36, Portman Square, London, W.1.

PROCEEDINGS OF

THE ANNUAL GENERAL MEETING

25th January, 1951.

THE Annual General Meeting of the Institution was held at 36, Portman Square, London, W.1, on Thursday, 25th January, 1951. The President, Major-General K. C. Appleyard, C.B.E., occupied the Chair.

Annual Report.

In presenting the Annual Report of Council, the Chairman of Council, Mr. Walter Puckey, said :

" A review of the past must be factual and gives little opportunity beyond a recital of the good and the bad which we have experienced. I am glad to report to you that during the year under consideration much more good than bad was accomplished. The good stands principally to the credit of my predecessor, Mr. John Hill, while the little that was, let us say not so good, must be shared among us all.

" It was not an easy year at Head Office, as during that period our Chief Executive Officer, Major Thorne, became a candidate for Parliament, and almost inevitably difficulties arose. His subsequent resignation and the appointment of Mr. Woodford as Acting Secretary are now history and are reported upon only for the record.

" Let me now deal with the other principal items that have concerned your Council over the year 1st July, 1949, to 30th June, 1950.

FINANCE "I will not trouble you with details of the Accounts as the Balance Sheet and Statement of Income and Expenditure for the year have already been circulated to all members. In accordance with the requirements of the Companies' Act, the Accounts of our Sub-Councils in Australia and South Africa and of the Sections in Bombay, Calcutta and New Zealand have been amalgamated with the United Kingdom Accounts.

" I am happy to report that our financial position has been considerably strengthened, and additional subscription income during the year amounted to approximately £10,000. The loyal response of members to the increased subscription rates shows their very clear determination that the Institution shall not be prevented by lack of funds from playing its full part in the professional and

industrial life of the country. I take great satisfaction from the fact that only 3 per cent. to 4 per cent. of the total membership resigned as a result of the increased rates of subscription.

" Expenditure at all times is very closely watched by your Finance and General Purposes Committee to ensure that Institution funds are spent to the best possible advantage. The dictates of policy sometimes justify and indeed demand that certain additional expenditure should be incurred ; such a case was the launching of the Schofield Travel Scholarships during the past year. Your Council consider that these Scholarships are of such great importance and value that the expenditure of £1,000 during the first year of the scheme has been fully justified.

" Your Council have also depreciated the book-value of furniture, fittings and stock to the extent of £716.

" Even after providing for these two quite substantial items, the Accounts reveal a surplus of income over expenditure of £496. When compared with the deficit of £7,500 in the previous year, I am sure you will agree that this is a very marked improvement in our position. It should not, however, be taken complacently. The Institution has much important work in the years that lie ahead ; furthermore, there will be the major problem of providing new Headquarters for the Institution when our present lease expires in about ten years' time. Our efforts to strengthen the Institution both financially, numerically and technically must, therefore, not be allowed to relax.

MEMBERSHIP

" The total membership at 30th June, 1950, amounted to 8,324, showing the following comparison with last year :

	1950	1949
Honorary Members	6	6
Members	1,234	1,304
Associate Members	3,649	2,637
Intermediate Associate Members	570	1,393
Associates	153	155
Graduates	1,675	1,377
Students	751	812
Affiliated Firms	196	201
Total	8,324	7,885

" This showed a net increase over the year of 439 members in all grades. As the Institution has grown over the years, your Membership Committee have steadily raised the standard of technical training and practical ability required of candidates for membership, and this is being reflected in the quality of individuals applying for membership of the Institution. Nevertheless, Council

knows that there are in the ranks of industry a great number of fully qualified persons who would make worthy members of the Institution, and whose assistance in our professional activities would be valuable indeed. For this reason, your Council has set a target for a net increase of 1,000 members in all grades during the current year, and I ask every member to do his utmost to introduce to the Institution men of the highest qualifications to assist us in our national work.

EDUCATION

" The past year has been an extremely busy one for the Institution's Education Committee, and a number of very important developments have taken place under their guidance.

" The inauguration of the Schofield Travel Scholarships is amongst the most important of these. These Scholarships provide for the successful candidates to spend a period of up to six months in a foreign country to increase their knowledge and experience of production engineering and to study the social life and background of other nations. The Scholarships, for which all graduate members of the Institution are eligible, are among the most valuable awards open to the young man in industry today, and your Council hope that when they are more widely known, they will be very highly coveted prizes indeed. The two successful scholars in 1950 whose names I will read to you later, spent six months in the United States of America.

" Another major educational development was the introduction of the Associate Membership Examination. The new regulations came into force on the 1st September, 1950, and the first examinations to be held under this scheme will take place during the week beginning 21st May, 1951. Your Council are convinced that this is one of the most important steps ever taken by the Institution, a step which will not only ensure that candidates for admission to corporate membership shall be individuals of high attainment, but will do much to increase the prestige of the Institution.

" A third and equally important project of the Institution launched by the Education Committee last year was the first Annual Summer School, which was held at St. Peter's Hall, Oxford, from the 30th August to 3rd September, 1950. The success of the first Summer School was such that your Council, on the recommendation of the Education Committee, have decided to make it an annual event, and plans have already been made for the 1951 Summer School to take place at University College, Durham.

" A memorandum on the Institution's future Education Policy has been approved by your Council, and will be published early in 1951. This memorandum emphasises in particular the need for further developments in the " sandwich " type of course, which is

of particular value to students of production engineering. It is interesting to note that the National Advisory Council for Education in Industry and Commerce has made similar recommendations in its final report to the Minister of Education.

" Of 177 candidates who sat for the Graduateship Examination (once again an increase over the previous year), 135 passed and 38 failed, whilst four candidates were referred in one subject.

" A considerable number of Technical Colleges have either launched or are considering the development of courses for the Higher National Certificate in Production Engineering. This trend is very encouraging, although it will be appreciated that results in terms of increased numbers of certificates awarded will not be apparent to any great extent for a further two or three years.

Institution Awards.

" The following awards were made during the year :

Institution Medal—for the best paper presented by a *non-member* during the year 1948–1949, to R. F. Tylecote, for his paper entitled " Pressure Welding."

Institution Medal—for the best paper presented by a *member* during the year 1948–1949, to Peter Spear (Graduate), for his paper entitled " The Generation of Fine Finishes by Machining Techniques."

Schofield Travel Scholarships 1950. The two 1950 Scholarships were awarded to Messrs. B. E. Stokes and W. N. Aspinall (Graduates).

Lord Austin Prize 1949—for the best essay by a Graduate, to E. R. Unitt, for his essay entitled " The Production of Screw Threads by the Grinding Method."

Certificate of Merit—to H. G. Bottomley (Graduate), for his essay entitled " Recent Developments of Production Grinding Machines."

Hutchinson Memorial Award—for the best paper presented by a Graduate 1948–1949, to Peter Spear, for his paper entitled " The Generation of Fine Finishes by Machining Techniques. "

THE JOURNAL

" Your Technical and Publications Committee have continued their good work in producing the monthly Journal under very difficult circumstances. Many criticisms and suggestions for improvement of the Journal have been received, and they have all received the most careful consideration of the Committee. One of the major obstacles which has stood in the way has been the question of cost. I am happy to report that, as a result of negotiations carried out by the Chairman of the T. & P. Committee

with the Institution's Journal Advertising Contractors and Journal Printers, revised terms mutually acceptable to all parties have been agreed, which will result in considerable savings to the Institution. These changes take effect from the 1st January, 1951, and it is intended that a considerable part of the savings should be devoted to the improvement of the Journal.

"Although the Journal is primarily intended to carry the 'Proceedings' of the Institution, a number of articles have been published during the past year dealing with Institution Policy, in order that members shall be informed of the development of Institution affairs. A further innovation has been the regular publication of a report of Council.

"The Common Subject on which papers were read throughout the Institution during the year was "The Effective Use of Materials," and many interesting papers on this subject were presented. Altogether a total of 190 papers and lectures on a wide variety of Production Engineering subjects were presented to Sections of the Institution during the year, and as many of these papers as circumstances permitted were published in the Journal. A full list of papers presented can be obtained from Headquarters and copies of almost every paper presented to the Institution are available from the Hazleton Memorial Library.

HAZLETON MEMORIAL LIBRARY

"It gives me the greatest possible pleasure to refer to the opening of the Hazleton Memorial Library. This event was made possible by the great deal of hard work put in during the year by a number of enthusiastic Graduate members of the Institution. The Library has been so named as a permanent memorial to the loyal and inspired service rendered to the Institution by its first full-time General Secretary, the late Richard Hazleton.

"The Library was ceremoniously declared open by the President of the Institution on 26th October last. A fully qualified librarian has been appointed and the reference facilities offered by the Library are already very much in demand. Over 1,500 volumes are already contained in the Library and more than 80 regular periodicals of interest to production engineers are available.

STANDARDISATION

"Your Standards Committee have again had a very busy year. Nineteen members of the Institution were appointed as representatives on various British Standards Institution Technical Committees, and it is interesting to note that our Institution is now represented on no less than 92 of the Committees of the B.S.I. It is a matter of great satisfaction to your Council that the Chairman of the Standards Committee, Mr. J. E. Baty, has been nominated by the Mechanical Engineering Industry

Committee of the B.S.I. to serve as one of the three representatives on the Engineering Divisional Council of the B.S.I.

" The Institution was represented at a Conference in Paris concerned with the International Organisation for Standardisation of Small Tools. The Institution was also represented at the Anglo-American Conference on ' The Unification of Bolts, Nuts and Screws ' held in New York.

" In addition, your Standards Committee have received for comment very many draft specifications from the B.S.I., who have expressed their appreciation of the co-operation and assistance rendered by our Institution. A number of useful suggestions for standardisation have been received from members, and these have been passed on by the Standards Committee to the B.S.I.

RESEARCH

" Considerable interest was shown by Industry, Government Departments and the Press in the Interim Report of the Joint Committee on ' The Measurement of Productivity.' This Report was published in December, 1949, jointly by our Institution and the Institute of Cost and Works Accountants, and requests for copies are still being received at Headquarters.

" Following the publication of the Interim Report, the work of the Joint Committee has, in the main, been carried out by three Sub-Committees, dealing with ' Time Study Training,' ' Machine Utilisation ' and ' The Measurement of Efficiency of Processes.' It is hoped that the findings of these three Sub-Committees will be published in further Reports of the Joint Committee in the very near future.

" The Institution gave valuable assistance to the University of Birmingham in making all the necessary administrative arrangements for the Work Measurement Research Unit of the Department of the Principles of Engineering Production to carry out a nation-wide survey of ' Time Study Rating Practice '. Many thousands of observations were made by the Research Unit, and it is hoped that the results of this survey, when published, will be of considerable value to Industry.

" The following members of the Institution were included in the Anglo-American Council on Productivity's Team on ' Materials Handling ' which visited the United States during the year :

Mr. W. J. T. Dimmock (Secretary of the Team).

Mr. W. M. Hiorns

Mr. L. W. Robson

" The Institution has made strenuous efforts to bring to the attention of industry the recommendations contained in the Report of this Team, and has sponsored a number of Conferences and

Meetings dealing with the subject, the most prominent of which were those organised by the Coventry Section and the Bristol Section in the Spring of 1950.

" As a practical demonstration of its keen interest in the subject, the Institution had a stand at the Mechanical Handling Exhibition at Olympia in June, 1950. An exhibition of books, pamphlets and photographs dealing with mechanical handling was on display on the stand, which was also fitted as a lounge for the convenience of members. The exhibition coincided with almost the only heat-wave of the year, and many members and friends, who visited the stand and took advantage of the facilities offered, expressed great appreciation of this service.

" The Materials Handling Sub-Committee of the Research Committee has been engaged in preparing schemes of education and training for the consideration of the Education Committee, with a view to ensuring that adequate provision is made for the teaching of Materials Handling in this country. It is hoped to issue a Report shortly.

" The work of the Research Committee has now reached the stage where the services of a full-time Technical Officer are desirable. It is hoped that such an appointment will be made some time during the next financial year.

LOCAL SECTION ACTIVITIES

" During the past year much valuable work has been carried out by all Sections to advance the aims and objects of the Institution. The activities of all our Sections have been so many and varied that it would be impracticable for me to detail them all here. I will, however, refer to one or two of the most outstanding occasions. The Institution owes a tremendous debt to the loyalty and enthusiasm of the officers and committees in the Local Sections, and I should like to express my personal appreciation to them for all that they have done during the year.

OVERSEAS SECTIONS

" In order to provide for the maximum possible co-operation and exchange of views between the Council in the United Kingdom and the Sub-Councils and Sections overseas, it has been decided that the Vice-Chairman of Council should act as liaison officer. It will be his responsibility to advise all overseas Sub-Councils and Sections on developments in Institution Policy and affairs in the United Kingdom, and, at the same time, to act as spokesman on behalf of the overseas members at meetings of Council in Great Britain. In spite of the difficulty of great distances which separate many of our members of Sections outside the United Kingdom, these Sections are all showing ever-increasing activity, and all the members are to be congratulated on their enthusiasm.

Australia.

" Membership is increasing steadily and the Sections have organised many interesting meetings. Institution influence in the Commonwealth has been further extended by the formation of a Section in Adelaide.

" Mr. Jack Finlay, M.B.E., one of the Institution pioneers in Australia, has been elected to Honorary Membership of the Institution in recognition of the many years of loyal and active service which he has rendered to the Institution. Mr. J. M. Steer resigned from the office of Honorary Secretary of the Sydney Section after many years of service. He has been a great worker or the Institution, and it is in no small way due to his efforts that the Institution has made such progress in Australia.

India.

" Both the Bombay and Calcutta Sections have been very active during the year. Attendance at Section Meetings has been satisfactory, and membership is steadily increasing.

" It is hoped that an Indian Sub-Council similar to those operating in Australia and South Africa will be established in the not-too-far-distant future.

New Zealand.

" Institution activities in New Zealand are restricted due to the small and widely scattered membership. However, a number of well-organised meetings have been held in Auckland, and it is hoped to extend activities by holding meetings in Wellington.

" Mr. Eric Paton, the Section President, is making splendid efforts to build up the Section under somewhat difficult circumstances.

South Africa.

" The work of the Institution in South Africa is progressing favourably, and many well-attended meetings covering a wide variety of subjects have been held. Activities in South Africa are mainly centred in Johannesburg, but plans are now going ahead to form another Section in Durban.

UNITED KINGDOM ACTIVITIES

" In the 1949-50 Session a total of 200 comprehensive and interesting lecture meetings were conducted, and many works visits were arranged by Sections.

" The formation of the Liverpool Graduate Section and full status for the Lincoln Sub-Section have been approved by Council,

who have also given approval for the formation of a Sub-Section of the Manchester Section at Stoke-on-Trent.

" Valuable work has been carried out by the London Section in establishing three new Sub-Sections, at Reading, Rochester and District, and South Essex. The Committee of the London Graduate Section organised two highly successful industrial tours of Sweden. In addition, they arranged the first London Graduate Weekend School which was held in Surrey. They are to be complimented on their enthusiasm and initiative.

" In view of its nation-wide importance and influence on industrial efficiency, the Institution has, as I have already mentioned, given a great deal of time and thought to the study of Materials Handling. Most Sections have included a lecture on this subject in their programme, and One-day Conferences were held in Bristol and Coventry, both of which met with enthusiastic support and were highly successful.

" A Conference of Section Honorary Secretaries of the Institution was held in May, attended by twenty-two Section Hon. Secretaries. These Conferences are valuable, both from the point of view of administration, and the personal contacts which are made.

HONOURS

" I have great pleasure in recording that, during the year under review, His Majesty the King conferred the following awards on members of the Institution :

J. J. Gracie, Esq.—C.B.E.
F. T. Hearle, Esq.—C.B.E.
J. W. Howlett, Esq.—O.B.E.
J. R. Pearson, Esq.—O.B.E.
G. A. Alldred, Esq.—M.B.E.
J. Onions, Esq.—M.B.E.
J. B. Stevenson, Esq.—M.B.E.

HONORARY MEMBERSHIP

" In recognition of his services to the Institution and to the Profession of Production Engineering over a great many years, Council have elected Mr. F. Grover of the Yorkshire Section an Honorary Member of the Institution.

OBITUARY

" The deaths of the following members during the year 1949-50 are recorded with great regret :

Mr. I. F. Bellringer
Mr. H. M. Brack
Mr. F. E. Brierley
Mr. W. H. Bryce
Mr. L. B. Bull
Mr. G. E. Goodwin
Mr. V. A. Hayward
Mr. H. Ison
Mr. W. G. Maw
Mr. J. Murphy

Mr. F. C. Clarke
Mr. W. Clough
Mr. F. L. Daniels
Mr. H. Denham
Mr. L. M. Ellis
Mr. A. Elword
Mr. N. Endacott
Mr. G. E. France
Mr. C. Godden
Mr. A. E. Newby
Mr. H. Nock
Mr. H. G. Scott
Dr. G. Schlesinger
Mr. A. F. Shillington
Mr. E. L. Stead
Mr. D. Tiranti
Mr. A. M. Willis

CONCLUSION

" May I, before closing, dwell briefly on the future? For the nation I foresee continued anxiety, which is shared with a world split by ideological conflict, and which may at any time degenerate into physical warfare. For the production engineer I forecast an ever more onerous and responsible place in national and world affairs. If we, as I fervently hope, maintain some semblance of peace, his great problem will be to increase productive efficiency in order to maintain, if not to increase, our standard of living. Many forces, such as rearmament, inflation and materials shortages are working to bring down our living standards. On the production engineers, more than almost any other group, rests responsibility for counter action.

" If we do fall over the brink into the horrors of modern war then the production engineer will, in this mechanised age, be faced with the greatest challenge he has ever faced. It will involve in a short period a complete change-over to war production, and memories still recall what that meant in 1939-40.

" Are we equal to these challenges ? I say with confidence that because of our Institution and the loyal unselfish work of its many members, we and the nation are better equipped than ever before to deal with the future.

" Active membership of our Institution is therefore not only of technical importance, it is a social duty. To all the colleagues who are at present so actively helping me to carry out Council's policy, may I express, first of all, grateful thanks ; to the others, may I quote the closing sentences of some remarks I made recently at the Inaugural Meetings of certain Sub-Sections :

' May I stress the work to which the Institution of Production Engineers has dedicated itself? As a professional body it is comparatively young, only 30 years old, but then, a scientific conception of Production Engineering itself is young in our country. Among our 8,500 members spread over 30 Sections at home and the Empire will be found men of the highest industrial rank as well as students on the lowest rung. While born of engineering and having an engineering background, Production Engineering

is now being practised in an ever-wider cross-section of industrys including the Armed Forces, and one of our principal problems is to satisfy the growing demand for first-class Production Engineer, and Managers. Without, I hope, too much presumption, we feel that national productive efficiency will improve more rapidly through the efforts of Production Engineering Managers than by almost any other group, and it is on that basis that we extend an invitation to all men who feel they are qualified, or wish to qualify for membership of the Institution. Come in and help us in our task. If indeed you can by one stroke achieve the dual satisfaction of public service and greater production efficiency, then you will surely be well rewarded.'

" I am very glad formally to move the adoption of this Report, together with the Statement of Income and Expenditure, Balance Sheet and Auditors' Report for the year ending 30th June, 1950."

The Vice-Chairman of Council, MR. HAROLD BURKE, in seconding the adoption of the Annual Report, said that the Chairman's opening remarks were to the effect that all the good work of the Institution was due to his predecessors, and in that members would support him very strongly. But Mr. Puckey did himself a disservice when he stated that all the best things belonged to the past, and that all the things which were not so good belonged to the year under review. He was too modest. Mr. Puckey had given a very clear picture of what the Council had endeavoured to do, and of what it had succeeded in doing.

Looking forward, he had given a picture of what might be achieved in the ensuing year. Several times the word " complacency " had occurred, but Mr. Burke wanted to say that in Mr. Puckey's vocabulary that word just did not exist. Satisfactory progress had been made over the year, but even more satisfactory progress lay ahead, and the Council looked forward with much encouragement to the year 1951.

MR. W. MOSEY said that over the past year he had been a little puzzled as to the direction the Institution was taking. Was the Institution becoming a body which was more and more concerned with mass production, or was it still as broad in outlook as when it started ?

THE CHAIRMAN OF COUNCIL, in reply, said that Council had been criticised by many people from time to time for tending to the larger firms and not bothering about the smaller firms, which constituted 90 per cent. of British industry. That criticism was probably well founded, and from time to time something was done about it. At the forthcoming Harrogate Conference special attention would be devoted to what was called " The Problems of the Smaller Firm."

Against that should be added the fact that many of the larger

firms, because of their size and facilities, were able to carry out research in one form or another which was not capable of being undertaken by smaller firms. It was readily appreciated that yesterday's research might be tomorrow's commonplace, so that it was not necessary to apologise for the larger firms because they could lead in certain techniques in which the Institution was interested.

Every endeavour was being made next year to devote more and more attention to the application of techniques to the smaller engineering firms.

MR. E. C. GORDON ENGLAND congratulated the Chairman of Council on his admirable report, which was very informative, but added that he rather hoped Mr. Puckey would have dealt with the question of widening the Institution's influence on industry. There were some 152,000 firms in the country which were producing something. That was a large number of firms. The Institution had more than 8,500 members, which was a fairly small percentage, and he suggested that the Institution might widen its vision. It was too restrictive in outlook, and he would like to see it embrace all industry. He had yet to discover that there was any difference between producing an engineering product in the strict sense of the term, or producing a food, cosmetic, or what you will.

The Institution ought to have at least 50,000 members. The question of the small firm had been raised. The small firms would become increasingly important if such a catastrophe feared by the Chairman were to be faced. It would be necessary to have dispersal of industry, which would mean small units. Therefore, if the Institution were looking at the country's safety, it ought to study and understand the best way of managing the small units. In his view, the day of the big unit was on the way out for social and economic reasons.

Therefore, he appealed to the Council to try and broaden the basis of the Institution and embrace all industries which produced.

THE CHAIRMAN OF COUNCIL said that he accepted Mr. Gordon England's very valuable comments. What he said was so eminently true. It was necessary, of course, to recognise that the standards for entry into the Institution must go higher rather than remain where they were, and when the practical aspect was examined, it was found that many men in charge of certain firms did not come within the yardstick for corporate membership of the Institution. That was no reason why they should be ignored ; they might be brought within the scope of the Institution if only they would tackle the job and improve their own studies accordingly. That job must fall, after direction by Council, upon the Section Presidents and the work in Sections.

It would be noticed that last year quite a number of people

entered the Institution who would not have been covered by the yardstick a few years ago. That was a deliberate attempt on the part of Council to recognise the fact that " production engineering " was really the " engineering of production," covering every industrial activity in the country. Therefore, Council was under no delusion about that matter.

If the membership were to be increased it must be on the basis of fully qualified members on the highest level.

MR. H. P. JOST said that, like many other members of the Institution, he was anxious that it should be granted a Royal Charter. In that connection it might be helpful to members if Council could give some guidance on this.

The Chairman of Council said that the attainment of a Royal Charter was ever in the forefront of Council's mind, and all their activities were being directed to this end. It must be remembered, however, that the granting of a Royal Charter by H.M. The King was a very high honour indeed, and the Institution must demonstrate beyond any shadow of doubt, in all its actions, that it was a body worthy of this honour.

THE PRESIDENT put the motion for the adoption of the Annual Report, which was carried.

Statement of Income and Expenditure and Balance Sheet and Auditors' Report for the Year ended 30th June, 1950. On the motion of Mr. J. E. Hill, seconded by Mr. B. G. L. Jackman, the Statement of Income and Expenditure, Balance Sheet and Auditors' Report, which had been circulated, were adopted.

ELECTION OF AUDITORS

On the motion of Mr. E. C. Gordon England, seconded by Mr. R. M. Buckle, Messrs. Gibson, Appleby & Co., Chartered Accountants, of Aldwych House, London, W.C.2, were re-elected Auditors to the Institution for the year 1950-51, and were thanked for their services during the year.

ELECTION OF SOLICITORS

On the motion of Mr. J. D. Scaife, seconded by Mr. T. Fraser, C.B.E., Messrs. Syrett & Sons, Solicitors, of John Street, Bedford Row, London, W.C.1, were re-elected Solicitors to the Institution for the year 1950-51.

TIME OF THE ANNUAL GENERAL MEETING

MR. R. HUTCHESON said he desired to raise a point in connection with the timing of the Annual General Meeting. He had not been able to consult his colleagues on the matter, but many members felt that the meeting should be held in the evening. He did not put it forward as a proposal, but merely as a suggestion to the Council, which might be considered. If the meeting were held in

the evening it might possibly be combined with some other function.

MR. H. P. JOST said he thought that there was a great deal in the point which Mr. Hutcheson had raised, but he did not agree with the suggestion that the Annual General Meeting should be combined with some other meeting.

MR. R. KIRCHNER supported Mr. Hutcheson. If the Annual General Meeting had been held at 7 o'clock in the evening at a suitable meeting place there would have been a good attendance and probably a lively discussion.

It was agreed that the point raised by Mr. Hutcheson would be noted for consideration by the Council.

VOTE OF THANKS

MR. M. SEAMAN said it was his pleasure to propose a vote of thanks to the President of the Institution, the Chairman of Council, and the Principal Officers.

In the President, the Institution was fortunate in having someone who was in contact with all the high authorities in the country, and who was a person of influence. He was indeed the essence of leadership.

Mr. Puckey, as Chairman of Council, was the real architect of the Institution's future policy, and the magnificent work which he had done could not be too strongly emphasised. He was ably backed by the Vice-Chairman of Council, and the Chairmen of Standing Committees. They were all members who realised that they had a job to do, and that there was only one standard, namely, the best.

The vote of thanks was carried with acclamation.

THE PRESIDENT thanked Mr. Seaman for the kindly way in which he had proposed the vote of thanks. As President, he saw a great deal of what went on, and the activities of Mr. Puckey and the amount of energy which he put into the Institution's work sometimes astonished him. The Institution was particularly fortunate in having Mr. Puckey as its Chairman of Council.

The Institution was also greatly indebted to the Section Honorary Secretaries—" those poor chaps who struggle with the paper which comes from Headquarters and who have to prepare their own paper work to send to Headquarters." They did a fine job for the Institution, as did the Chairmen of Section Committees, the Secretary of the Institution, and all members of Headquarters' staff.

The meeting then terminated.

INSTITUTION AWARDS

Lord Austin Prize

This prize consisting of books and/or instruments together with a certificate, is presented annually for the best Essay submitted by a Graduate of the Institution. Details of conditions are published in the Journal each year.

Hutchinson Memorial Medal

A medal is awarded annually for the best paper presented to a Section by a Graduate of the Institution.

Institution Medals

Silver medals are awarded each year for the best paper presented to a Section during the year by (a) a member, and (b) a non-member.

Schofield Travel Scholarships

The Scholarships provide for two Graduates each year to spend six months on industrial study visits in selected overseas countries. Details and conditions of the Award are published each year in the Institution's Journal.

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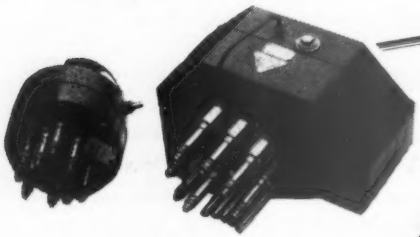

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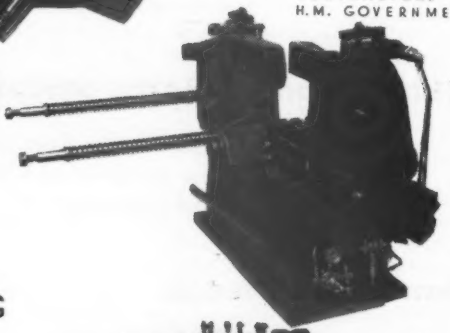

FOR THE
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AIRCRAFT
COMMERCIAL
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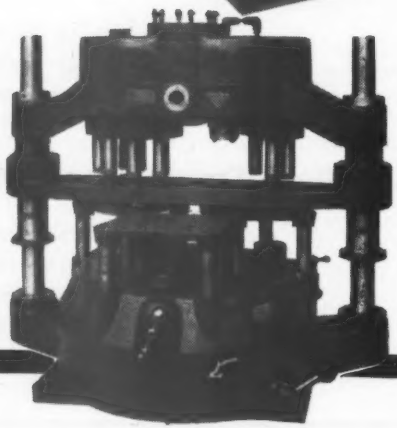

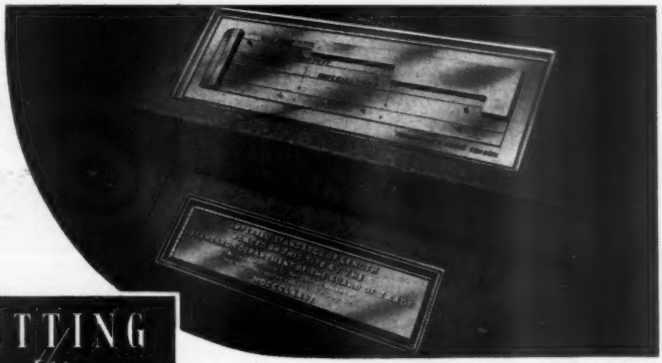

SETTING *the* STANDARD

Imperial Standards of Length
—Trafalgar Square, London.

In every branch of industry, in laboratories and scientific research establishments, in the services and, in fact, wherever electrical maintenance and measurement are of prime importance, "AVO" Electrical Testing Instruments maintain a reputation unexcelled for robustness and dependable accuracy. They are frequently used as a standard by which other instruments are judged.

The Model 7 Universal AvoMeter is a typical example of a modern "AVO" multi-range meter. It is a combination AC/DC instrument providing on a 5-inch hand calibrated scale 50 ranges of readings of Current, Voltage, Resistance, Capacitance, Power Output and Decibels. The total resistance of the instrument is 500,000 ohms, and its small power consumption and precision accuracy make it the choice of radio, television and electrical engineers throughout the world.

Write for a FREE copy of the Comprehensive Guide to "Avo" Instruments.

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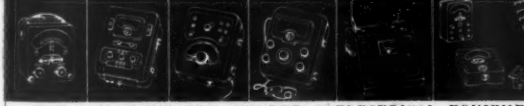

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WINDER HOUSE · DOUGLAS STREET · LONDON · S.W.1 *Telephone: VICTORIA 3404/9*

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Machinery
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THE WORLD RENOWNED Lorch LATHES ARE HERE AGAIN
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Quick deliveries

VERY COMPREHENSIVE RANGE
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The Boxford

Lathe is a Precision Built Lathe with Machine Cut Gears throughout. Experience in the production of precision jigs and fine instruments is behind the manufacture of all Boxford Lathes. Close limits are held during manufacture and the finished product is unequalled in its class.

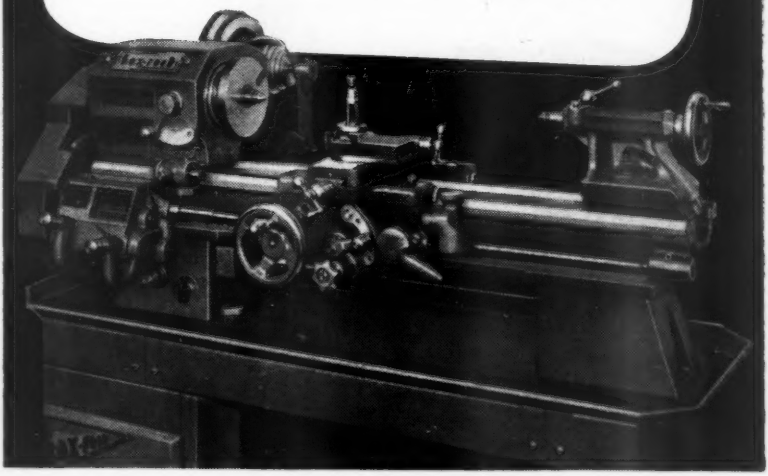
BRIEF SPECIFICATION

Swing over bed 9". Between centres 21" or 29"
Number of speeds 16 — 40 to 1300 r.p.m.

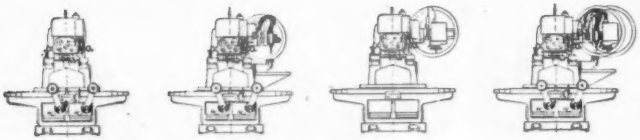
3 models—prices from £95 10s. 0d.

Full details from :—

T. S. HARRISON & SONS LTD., HECKMONDWIKE, YORKSHIRE



FOUR variations



of one machine!

The unique design of the Cincinnati Vertical Hydro-Tel permits it to be constructed in four variations from the basic machine. 1. *As a General Purpose Milling Machine.* This is the basic machine with hand and power feeds fitted to table and cross-slide and hand feed to vertical spindle carrier as standard. Power feed is available for the latter when required. 2. *Die Sinking Machine with Automatic Depth Control* giving Automatic tracing mechanism as a die-sinker, but can still be used as a general purpose vertical miller. 3. *Automatic* 360° *Profiling Machine.* A completely automatic machine, the table and cross slide movements being entirely controlled by the profiling mechanism. 4. In this variation both the Die Sinking attachment with Automatic Depth Control and the Automatic 360° Profiling equipment are added to the basic General Purpose Milling Machine. Details of these unique multi-purpose machines are available on request.

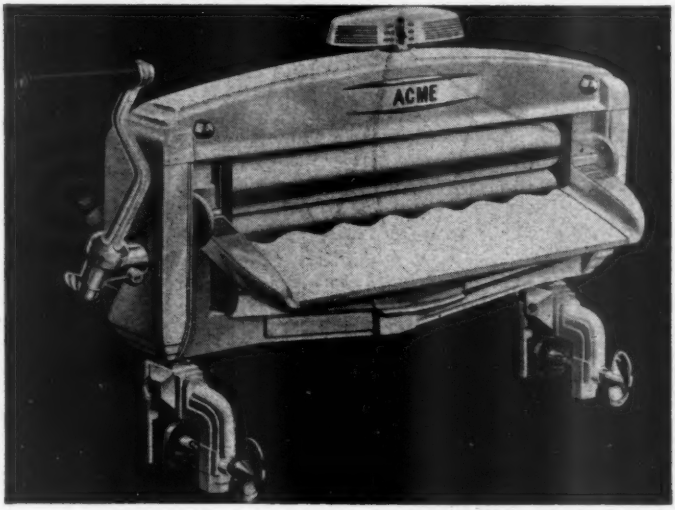
CINCINNATI

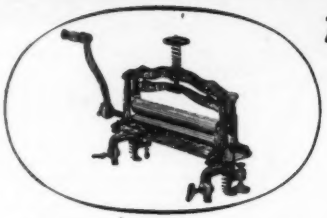
• • • VERTICAL HYDRO-TEL • • • • • • • • • • •

MILLING MACHINES

CINCINNATI MILLING MACHINES LIMITED, BIRMINGHAM, 24

Sales Representatives for the British Isles:
Charles Churchill & Co. Ltd., Coventry Road, South Yardley, Birmingham, 25





ZINC ALLOY DIE CASTING

makes all the difference!

No one can doubt that the modern wringer shown above is streets ahead of the old model recalled in the small sketch. Through the sensible adoption of zinc alloy die castings it is easier to work, pleasanter to the eye, and more economical to produce. Zinc alloy die castings are used for the handle, clamps, pressure gauge, mangling board sides and brackets, and also for various nuts and internal fittings.

Compared with cast iron, zinc alloy die casting gives more latitude to the designer, eliminates rusting and provides a choice of more attractive finishes, either by electroplating or enamelling.

Some facts about zinc alloy die casting.
Speed of production is an outstanding feature of the die casting process — the shortest distance between raw material and finished product. Zinc alloys are the most widely used of all metals for die casting because they yield castings with the following qualities:

ACCURACY: Castings can be made practically to finished dimensions and need little or no machining.

STRENGTH: Good mechanical properties for stressed components.

STABILITY: Close tolerances are maintained throughout the life of the casting.

British Standard 1004.
It is essential that alloys conforming to B.S. 1004 should be specified for all applications.

The Association welcomes inquiries about the use of zinc alloy die castings. Publications and a list of Members are available on request.

ZADCA ZINC ALLOY DIE CASTERS ASSOCIATION
LINCOLN HOUSE, TURL STREET, OXFORD

PRESS BRAKES

ELDAIR
PRESS BRAKES

ALL-WELDED STEEL FRAME
ANTI-FRICTION LINING BEARINGS
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STEEL MACHINE-CUT GEARS

ELDAIR is the last word in medium priced power Metal Bending Machines. It speeds production and lowers the cost, and is essentially a practical, precision tool invaluable to the sheet metal manufacturer.

Write to-day for details of ELDAIR Press Brakes and other Sheet-Metal working Machinery

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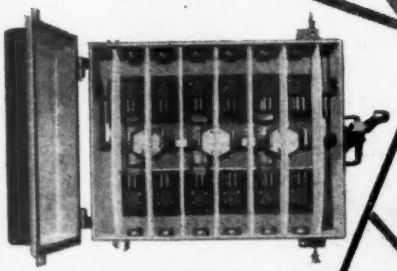
DONOVAN

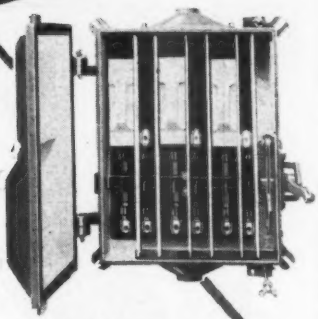
CHANGE-OVER SWITCHES FOR INDUSTRIAL PLANTS



TYPE S.35 "DONLOK" 100-Amp. T.P. Change-over switch.

Definite 'OFF' position with quick break from either 'ON' position.

The switches illustrated are robustly constructed for use in Industrial Plants, Power Stations and situations where reliability is a first consideration



TYPE SF.35 "SAFUSE" 60-Amp. T.P. change-over switch with fuses.

DONOVANS

THE DONOVAN ELECTRICAL CO., LTD.
Safuse Works · Stechford · Birmingham · 9

QUALITY · ACCURACY · SPEED · LONG LIFE

REAMERS

Our specialist plant is at your service for the production of "REAMERS OF ALL TYPES" made from the Firth Brown "Speedicut" range of high speed steels, with "Speedicut SATIS" for the exacting demands of high tensile and work-hardening materials.

Extensive stocks of all standard types are available. Your special requirements for all purposes can readily be met.

TWIST DRILLS—REAMERS
TAPS
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And all other types of Engineers' Cutting Tools.

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PRECISION
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13" to 30" Swing Centre Lathes. Surfacing and
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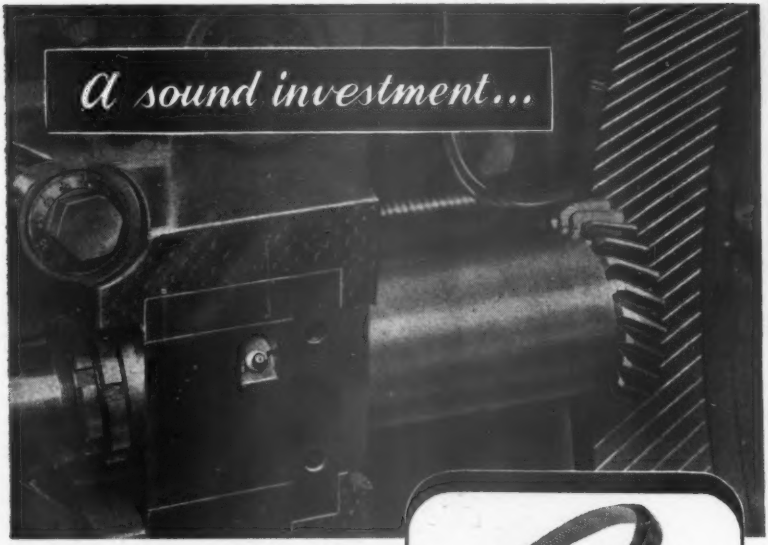
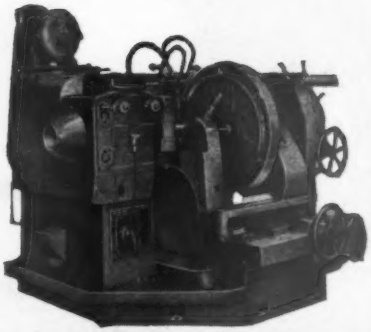


for your gear production

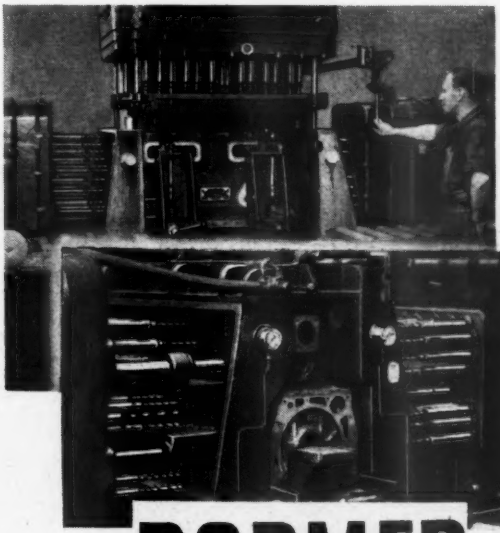


FOR those responsible for gear production there is no better investment than the Sykes Horizontal Gear Generator. This machine is capable of producing to the highest standards of accuracy, internal spurs and helicals in addition to external spurs, helicals and double helicals. It maintains a high continuous production rate almost indefinitely without loss of initial precision. This factor contributes to the exceptionally low maintenance and depreciation costs of Sykes Gear Generating Machines.

Type 3C for gears up to 40" diameter.

W. E. SYKES LTD.
STAINES · MIDDLESEX · ENGLAND
Tel: Staines 978 (2 lines) Grams: "Sykutter, Staines"

SYKES



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DRILLS

. . for uniform performance on multiple drilling

Consistency of dimension and performance are features users of DORMER drill's can be sure of.

Great attention is given in our Works both to the quality of the steel used and the dimensional accuracy necessary at every operation, in the making of DORMER drills.

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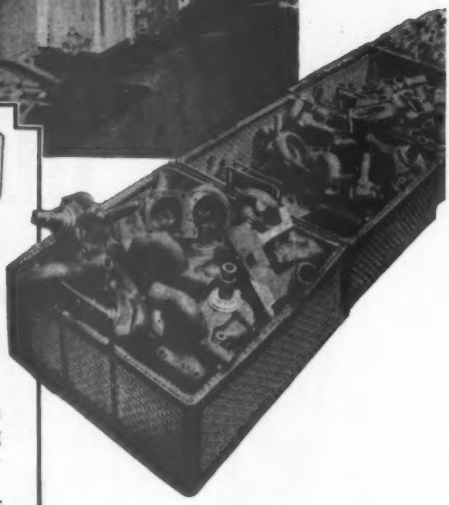
Manufacturers of High Speed Twist Drills, Reamers & Small Tools
Dormer Tools are obtainable from your usual engineers' merchants

Each cleaning problem studied individually



Bratby

INDUSTRIAL CLEANING MACHINES

This illustration shows a machine cleaning crank cases in the production line.

It is equally capable of cleaning small parts in baskets.

Photographs by courtesy of "Machinery."

Sole Agents for Great Britain :

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Designed and manufactured by :

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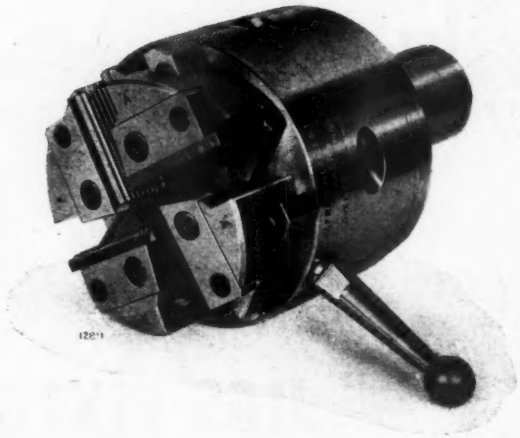
HERBERT



THE HERBERT TANGEL DIEHEAD

$\frac{5}{8}$" $\frac{7}{8}$" $1\frac{1}{4}$"

For threads that can be finished in one cut.

Uses standard Landis Tangential Chasers and chaser holders. Cuts right or left hand. Chasers are set very rapidly.

Using oversize chaser holders, short threads of fine pitch, much beyond the rated capacity of the diehead, can be cut.

IN STOCK

ALFRED HERBERT LTD · COVENTRY

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JIGS·FIXTURES & GAUGES

PRESS TOOLS · MOULDS AND SPECIAL PURPOSE MACHINES

of all kinds

Up-to-date shops specially laid out and equipped for making, on a production basis, every type of precision ground gauges; limit snap, form, calliper, taper and special purpose gauge, as well as jigs and fixtures of all kinds, press tools, moulds and special purpose machines. Highest class workmanship and accuracy guaranteed.

G.P.A. TOOLS & GAUGES LIMITED

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Members of the Gauge & Tool Makers' Association

Stellite Drills
FOR HARDENED STEEL
Remove
BROKEN TAPS
WITHOUT
ANNEALING
SIMPLY
DRILL
OUT
DELORO STELLITE drills have been specially developed for drilling steels harder than Rockwell C.51, Brinell 500 or Vickers 560. Send for leaflet B.19.
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• MILLING CUTTER BLADES • TIPPED TOOLS • WORKRESTS •

See our exhibit stand D.402, B.I.F. 1951, Castle Bromwich.

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A COMPREHENSIVE RANGE OF LINISHER BANDS, ECONOMY ROLLS, CLOTH SHEETS, WET OR DRY PAPER.

STOCKISTS OF "DUREX," "UNION GLUE," "OAKEYS," "GOLDSWORTHY," ETC.

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THE TWIST DRILL SPECIALISTS

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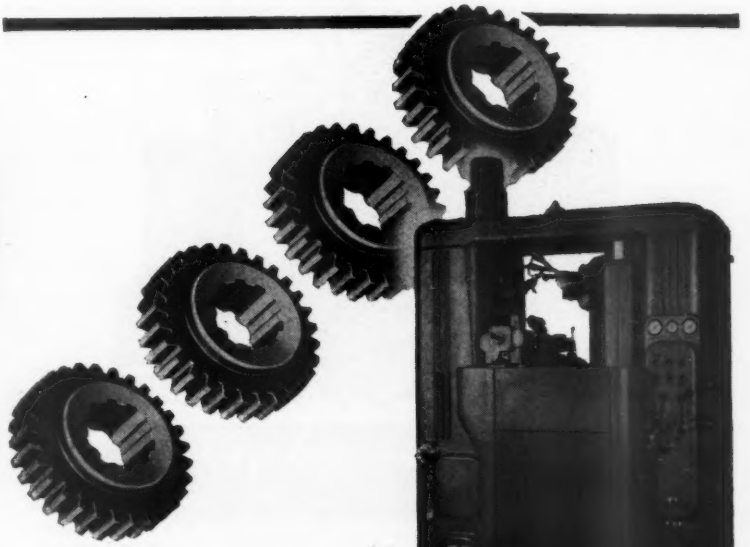
Phone: CALthorpe 3177 (3 lines) Grams: Emancee, Birmingham

LONDON OFFICE: 295, EUSTON ROAD, N.W.1 Phone: EUSton 5311 (3 lines) Grams: Emancee, London

CONSISTENT ACCURACY WITH HIGH OUTPUT

• • • • is the primary advantage offered by the Barber-Colman 8-10 Vertical Hobber. This machine has a capacity of 8" diameter by 10" long and is designed for high speed production of spur and helical gears or splines. Extra heavy, rigid structure plus the accurate mounting of the hob on the tapered hob spindle ensures consistent accuracy while the machine maintains a high output. Simple centralized control is effected by "push button." A lever sets in motion the semi-automatic cycle, while a simple selector regulates the "8-10" to either climb or conventional cutting. Increases in hob life ranging up to 50% are achieved by fitting the new Barber-Colman 8-10 hob shifter.



THE
BARBER-COLMAN
NO 8-10 *Vertical* HOBBING MACHINE

BARBER & COLMAN LTD., MARSLAND RD., BROOKLANDS, MANCHESTER
Telephone : SALE 2277 (3 lines) Telegrams : "BARCOL," SALE

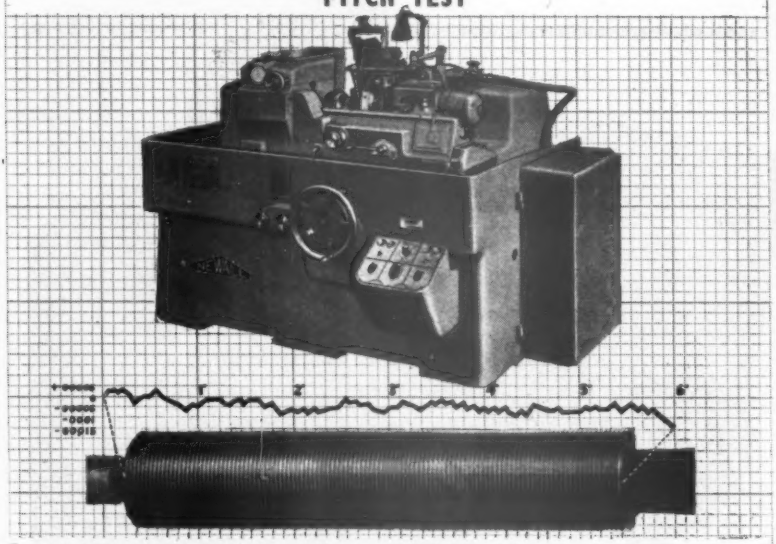
NEWALL N-L

The PITCH TEST

THREAD GRINDING MACHINE MODELS A & B

DATE 1-11-50 N-L THREAD GRINDING MACHINE SERIAL NO. 50/14

PITCH TEST



A stringent test to which this machine is subjected before being released by the inspection dept. is the pitch test.
For this an 18 TPI thread is ground on a hardened bar 6' long x 1¾" diameter and the pitch error in this length must not exceed ·00015.

Yet another feature to substantiate our claim that the N-L is one of the most accurate thread grinders in the world.

ONE OF THE NEWALL GROUP

NEWALL GROUP SALES LTD.
Tel: PETERBOROUGH 3227-8-9 PETERBOROUGH

Sole agents for Midland Area: Stanley Howard Ltd. 75-76, Exchange Buildings, Stephenson Place, Birmingham, 2.

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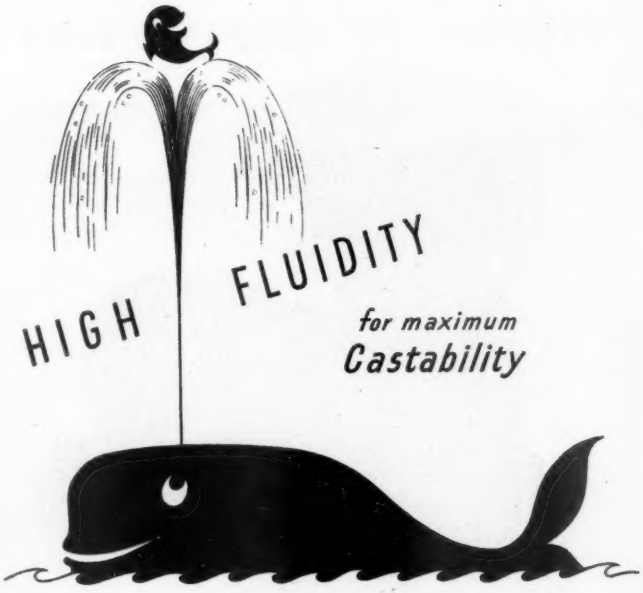
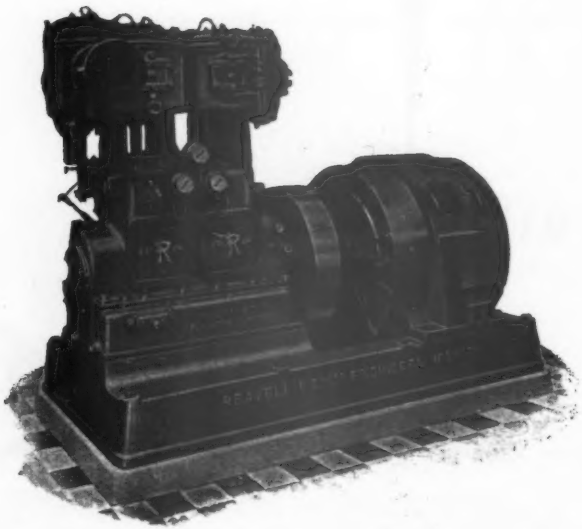


The low melting point and high fluidity of Mazak make it ideal for die-casting. There is practically no limit to the complexity of shape and intricacy of detail which can be reproduced. For instance, carburettors and mortise lock parts can be accurately pressure die cast in Mazak with little subsequent machining. The basis of Mazak is "Crown Special" Zinc of 99.99+% purity, one of the purest metals commercially available.

MAZAK

IMPERIAL SMELTING CORPORATION (SALES) LTD
37 DOVER STREET · LONDON · W.1

AIR COMPRESSORS



We have standard types for all capacities and pressures and can supply the most efficient and reliable machine for any duty.

REAVELL & CO. LTD. - IPSWICH

Telegrams: "Reavell, Ipswich." Telephone Nos. 2124-5-6

MOST ADVANCED *"fractional"* EVER OFFERED TO INDUSTRY

And it's backed by a HOOVER 5-POINT SERVICE PLAN

All sections of industry agree that the new Hoover F.H.P. Motor is easily the most advanced of its kind available.

Such general admiration can be attributed to the outstanding all-round performance of the new "Fractional", the quality of its construction and the superiority of its styling.

In addition to these advantages, the new motor is backed by a special Hoover 5-point Service Plan, providing users with facilities for both service and advice at their factories or workshops anywhere in the country.

That is why so many manufacturers are choosing the new Hoover F.H.P. Motor for inclusion in their products.

HOOVER LIMITED

INDUSTRIAL PRODUCTS DEPARTMENT

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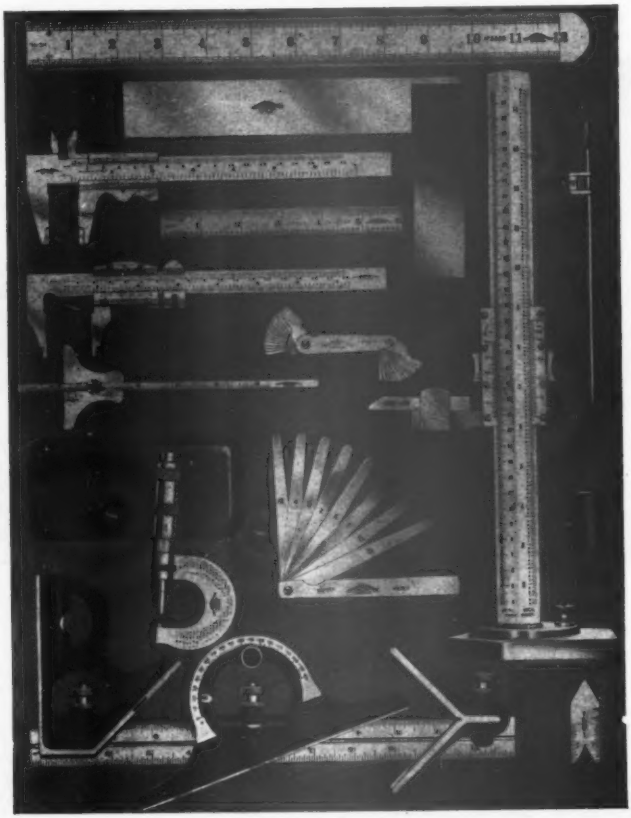
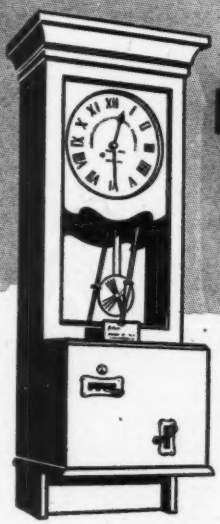
CHESTERMAN
ENGINEERS' PRECISION TOOLS



1829 *Foremost for more than a century* **1950**

JAMES CHESTERMAN & COMPANY, LIMITED,
SHEFFIELD, 11.



TIME is MONEY

The Gledhill-Brook Company was intimate with the early problems associated with the design and production of time recording machines, and was first in producing efficient electric impulse recorders with accurate time-keeping free from dependence on electric frequency or external influence. Wages and cost methods have a time basis — that is where we are concerned to help.

A large number of time recording models is now available covering most of the known needs for wages and labour cost control. One of industry's immediate needs is the reduction of waste—the waste of time that costs money.

GLEDHILL-BROOK

TIME RECORDERS

GLEDHILL-BROOK TIME RECORDERS LIMITED

20 EMPIRE WORKS HUDDERSFIELD

WOLVERHAMPTON
DIE-CASTING CO.
LTD.

MANUFACTURERS OF
ZINC AND
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ALLOY PRESSURE
DIE-CASTINGS
OF QUALITY

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PRECIMAX

GRINDING

Ensures close tolerances and high output on weighing machine components.

PRECIMAX precision grinding machines, cylindrical, universal or surface, are made in a range of sizes and types covering most requirements. Recommendations on your own work gladly given, on request.

At W. & T. Avery Ltd., Birmingham, this PRECIMAX U.P.H. 10/18 in. grinding machine is finishing stainless steel spindles for self-indicating scale dial mechanisms to precise limits.

MACHINERY

John Lund Ltd.

CROSSHILLS · KEIGHLEY · YORKS

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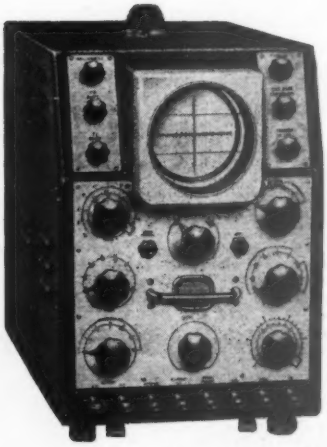

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Here are some details of Model 1049 as illustrated:

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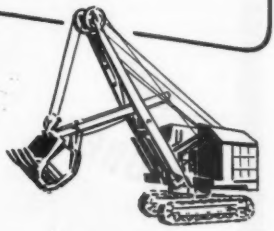

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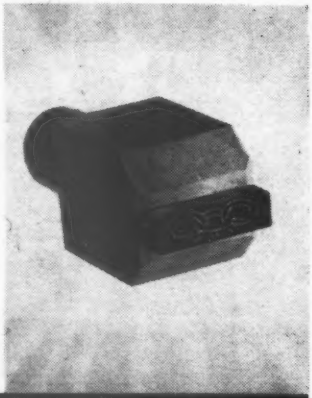

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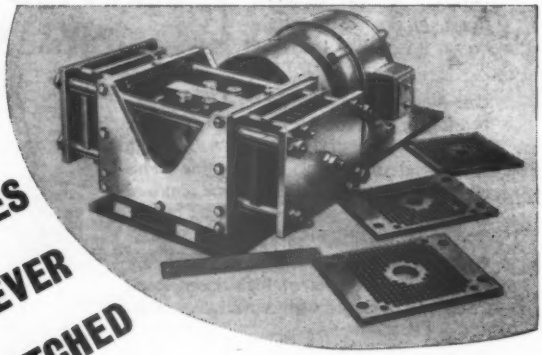

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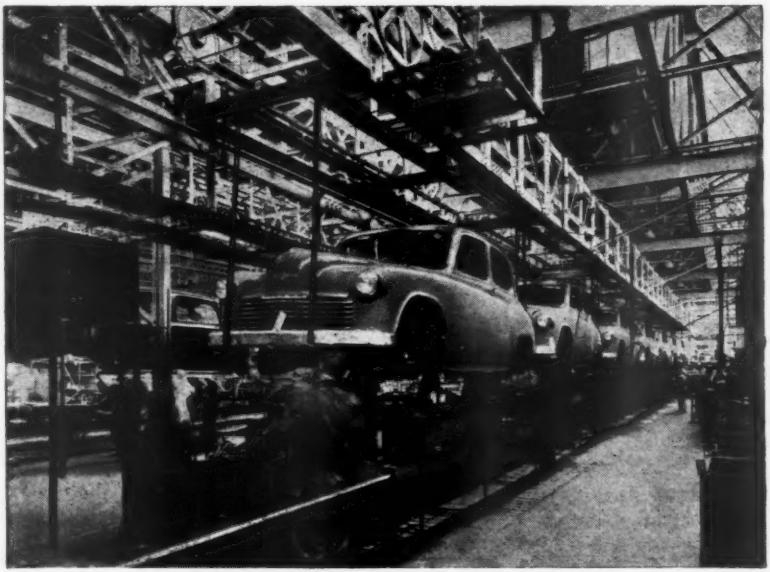

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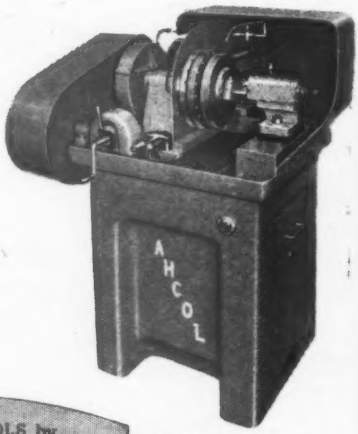

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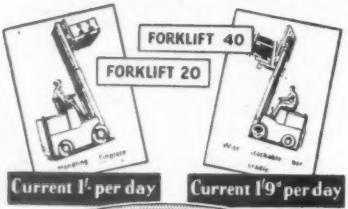

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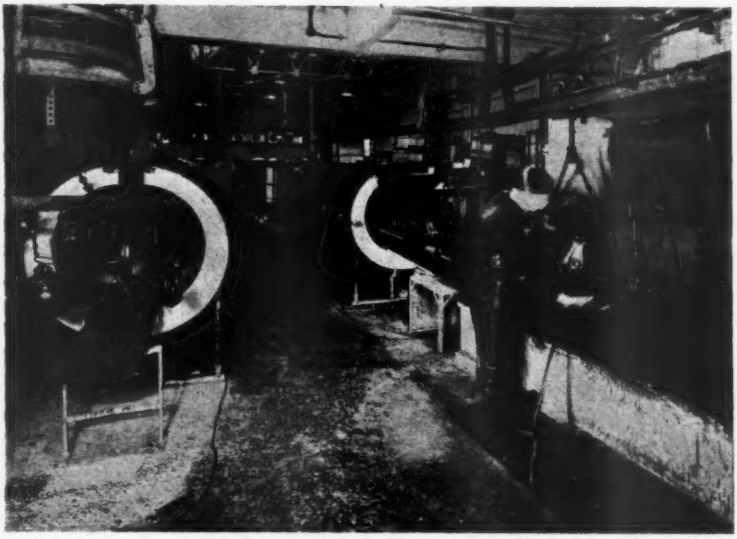

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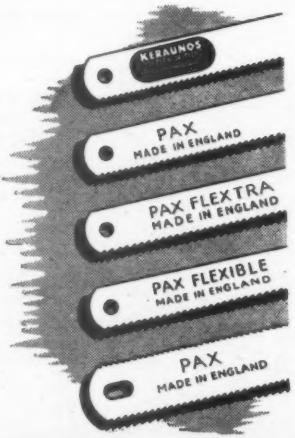

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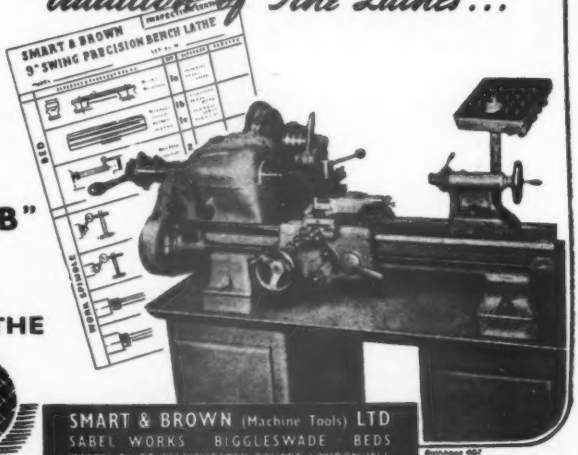

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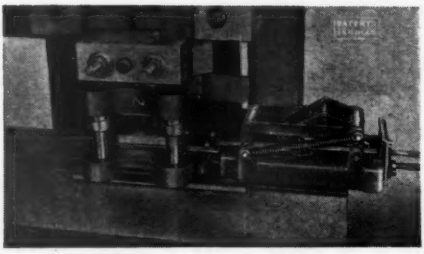

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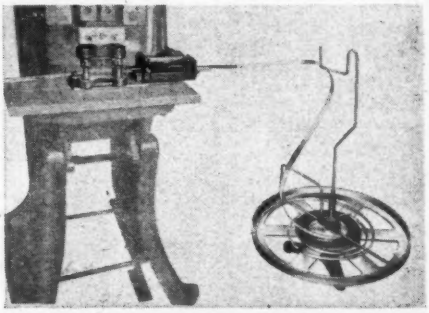

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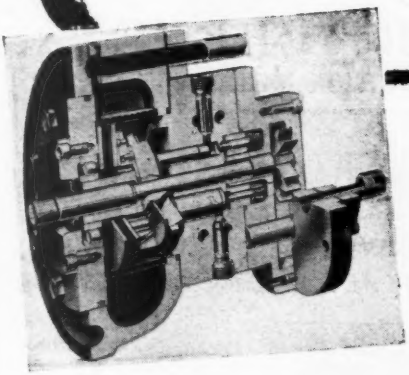

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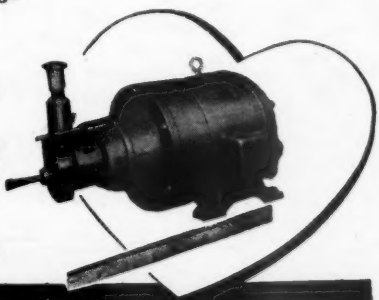

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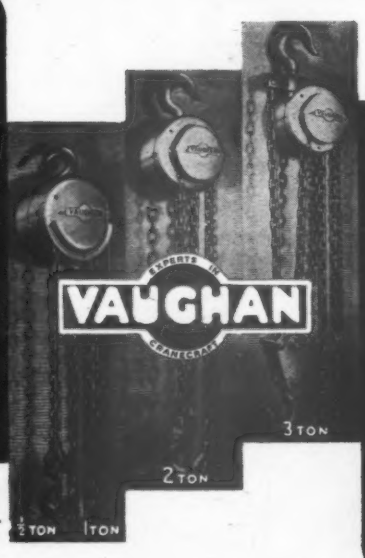

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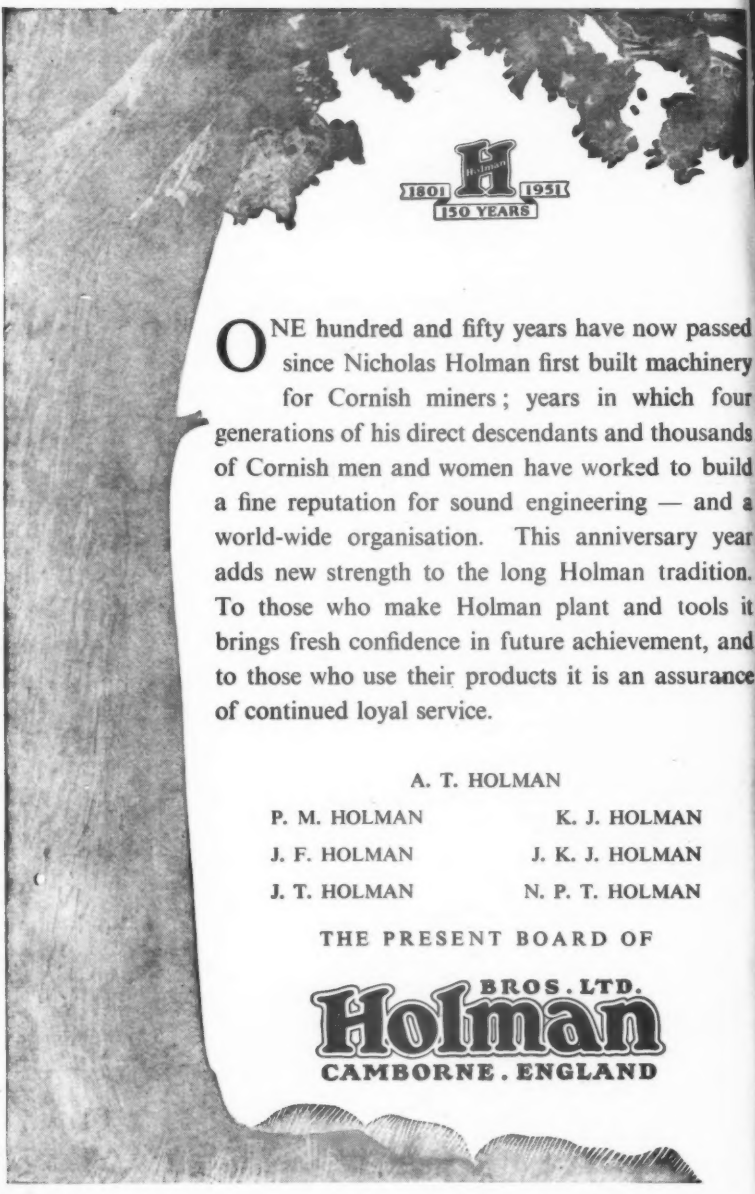

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